

# **REPORT ON CORE FACULTY TRAINING WORKSHOP ON DISASTER PREPAREDNESS (W.H.O. SPONSORED)**



**NATIONAL TEACHER TRAINING CENTRE  
JAWAHARLAL INSTITUTE OF POSTGRADUATE  
MEDICAL EDUCATION AND RESEARCH  
PONDICHERRY - 605 006.**

1991



02074





# **REPORT ON CORE FACULTY TRAINING WORKSHOP IN DISASTER PREPAREDNESS**

**[W.H.O. Sponsored]**

**Edited by  
D.K. Srinivasa**

National Teacher Training Centre  
Jawaharlal Institute of  
Postgraduate Medical Education & Research  
Pondicherry-605 006

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## FOREWORD

India is unique in more than one sense. Whereas nature has bestowed upon it not four but six seasons in the year, which bring in their wake a variety of crops, fruits, blossoms and natural sceneries, it also sometimes brings different types of miseries due either to lack or excess of the natural climatic variations. However, a large number of natural disasters occur throughout the year, in the form of drought, flood, tornadoes, tidal waves and even earthquakes, because of the subcontinent's geophysical formation. The recent earthquake in the Himalayas literally shook the entire northern India. It is not surprising, therefore, that the people and the Government of India have taken a variety of steps to meet the consequences of such disasters. It is indeed a matter of pride that, by and large, India has met these disasters with its own resources, both human as well as material.

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The health consequences of disasters are well-known. Disaster management requires integrated action between various sectors. In fact, disaster preparedness and measures for the prevention of disasters should be taken seriously by all. Geophysical changes consequent upon increased agriculture, often at the cost of forest lands, may make a particular part of the country vulnerable to disasters such as drought or floods. Land management, water management and creation of a healthy and strong environment go a long way in preventing some of the disasters. The taming of rivers, the creation of mega dams and the provision of irrigation canals may also seriously alter geophysical conditions. Malaria and waterborne diseases often emerge if appropriate care for the drainage and education of the people is not taken.

It is a matter of great satisfaction that the Government of India has taken keen interest in measures aimed at disaster preparedness.

The Core Faculty Training Workshop in Disaster Preparedness, conducted at JIPMER, Pondicherry, from 29 July to 1 August 1991 has made important recommendations which merit serious consideration and implementation. This is a step in the right direction.

I do hope that JIPMER can and will play an important role in disaster preparedness and management, particularly in the preparation of a data bank for disaster preparedness as well as in training personnel at various levels.

**Dr. D.B. Bisht,**  
*Director,  
Programme Management,  
World Health Organization,  
SEARO, New Delhi.*







## PREFACE

During recent decades, there have been significant advances in health as well as social and economic development. Yet this progress has been repeatedly interrupted by man-made and natural disasters that have exercised a terrible impact on the overall health and development of the communities and even of whole nations. The setbacks caused by these often devastating events have made it clear that we cannot pursue the long term strategies of Health for All and improvement of Quality of life without paying due attention to this global problem of disasters.

This decade is the International Decade for Natural Disaster Reduction (IDNDR). The World Health Organization has focussed the attention this year on disaster preparedness. The Ministry of Health and Family Welfare, Government of India has proposed to establish centres for training health personnel as a part of the disaster management programme. It is in this context that JIPMER

organised a Core Faculty Training Workshop from August 29–31st, 1991. This core faculty would later organise training for state and district level medical and health personnel on disaster management.

Scientific papers were presented by experts from various fields during the workshop. These experts were from the World Health Organisation, Central and State Governments, Training and Research Institutions and Voluntary Organisations (NGOs). The report incorporates the papers presented during the scientific sessions and the recommendations made by the participants regarding the future role of JIPMER as a collaborating centre for disaster preparedness and response. It is hoped that the deliberations presented would benefit planners, administrators, trainers and other health professionals towards achieving better preparedness and response to the disasters.

Pondicherry  
30th September 1991

D.K. SRINIVASA

✓  
“A Disaster occurs when one has nearly forgotten about its possibility . . .” Japanese Proverb  
“Should disaster strike . . . be prepared”—WHO theme, 1991



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## ACKNOWLEDGEMENT

Our sincere thanks are due to the Ministry of Health and Family Welfare, Government of India and the Director, Emergency Medical Relief, DGHS, New Delhi for providing an opportunity to conduct this workshop. We are also grateful to the World Health Organisation, SEARO, and in particular to Dr. Olavi Elo, WHO Representative to India for the financial grant and for the supply of relevant books and other training materials. We appreciate the contributions made

by the resource persons during the workshop.

Dr. S. Chandrasekar, Director and the staff of different units of JIPMER spared no efforts to make the workshop a success. The editorial assistance given by Dr. K.H. Krishnamurthy is very much appreciated. Dr. N. Ananthakrishnan, Dr. K.R. Sethurman, Mr. K. Vijayan Pillai, Sri G.K. Padmanabhan and the NTTC secretariat rendered valuable assistance in the preparation and publication of the report.







## BACKGROUND AND OBJECTIVES OF THE WORKSHOP

*Dr. S. Chandrasekar*

The crux of the history of disasters is essentially one of fatalism versus preparedness. Tragically fatalism has prevailed for most of the times in human history. The anger of Gods has been traditionally believed to manifest itself in catastrophic floods, droughts and volcanoes. Such a fatalism however is no longer acceptable. The causes of natural disasters are now scientifically explainable and are also generally well understood. It is therefore time to bring in the full force of scientific and technological advancement to reduce these havocs of human tragedy and the economic loss attendant upon these human disasters.

The decade 1990–99 has been declared by the United Nations as the International Decade for Natural Disaster Reduction (IDNDR). This is a call to all governments and the international community to work together to reduce the effects of disasters, particularly in the developing countries where the risks and the impacts of the natural disasters are the greatest. Naturally the health sector plays a critical role in all such aspects of disaster preparedness, response and relief.

The World Health Organisation (WHO) has declared "Should Disaster Strike . . . . Be Prepared" as the theme for 1991. The WHO in co-operation with governmental and nongovernmental organisations is backing up the emergency preparedness programmes of individual countries. These measures to improve awareness and preparedness can be classified into four categories:

- Training
- Technical cooperation
- Distribution of health information and
- Research in health preparedness and response.

In fact the focal theme for the 78th session of the Indian Science Congress held in Indore during January 1991 was "Coping with Natural disasters". The Congress devoted several sessions to research findings on various aspects of natural disasters, as well as about the scope for further research on

understanding them better and also for managing them more scientifically.

A better disaster preparedness in the health sector clearly requires a better training of medical and health personnel at all levels as well as the integration of key preparedness principles into the very curricula of training institutions.

The Ministry of Health and Family Welfare, Government of India has proposed to establish centres for such training of health personnel for disaster management. In this connection, two National meetings on Disaster Preparedness were held, one in November 1990 and another in March 1991 at the Directorate General of Health Services, New Delhi. Both were chaired by the Additional Director General of Health Services. Further, the Directorate General of Health Services, Government of India recommended selection on predetermined criteria of a few institutions in the country through which proper preparedness and response capabilities be developed and could be gradually propagated to state/district, primary health centres and subcentre levels."

### **The criteria for selection are as follows:**

- i) The centres selected should have acquired a commendable degree of status as centres of excellence.
- ii) They should have adequate teaching and research experience in the field of medical, public health and management.
- iii) They should have adequate teaching and research facilities.
- iv) *Place*: They should be easily approachable and preferably distributed properly in different regions of the country to undertake the diverse regional responsibilities.
- v) Preferably they should have been already recognised for collaborative activities by any United Nations agency.



The Jawaharlal Institute of Postgraduate Medical Education and Research (JIPMER), Pondicherry fulfills all the above criteria and has been therefore designated as one of the Centres for training key personnel of the health departments of State governments. The other two such selected centres are: All India Institute of Hygiene and Public Health (AIHPH), Calcutta and National Institute of Communicable Diseases (NICD), Delhi.

The following are the proposed responsibilities of the JIPMER centre for the year 1991:—

- Training of Trainers
- Development of curriculum for the training of Health Personnel in Disaster Preparedness
- Collection and dissemination of information
- Conducting case studies

In pursuance of the above, the JIPMER Centre prepared a plan of activities. They were meant to fulfill the following objectives:—

- 1) To organise training programmes for key training personnel at the State/District levels in the field of Disaster Preparedness.
- 2) To develop curricula and training modules in disaster preparedness for use by the health personnel and other workers at different levels.
- 3) To create a resource centre for promoting educational and training activities in the field of disaster management.

The activities proposed for the period of August to December 1991 were:—

- 1) Situation Analysis: This will be done through visits during September to December 1991 to Andhra Pradesh, Tamil Nadu and Pondicherry for data collection about the disaster preparedness and relief. A

report will be prepared based on the findings.

- 2) Preparation of a quarterly news letter
- 3) Conducting one core faculty training programme

The present workshop was held to train the core faculty at JIPMER from 29th to 31st August, 1991.

This core faculty is a multi-disciplinary group drawn from the departments of Medicine, Surgery, Orthopaedic Surgery, Pathology, Anaesthesiology, Microbiology and Community Medicine. Many of them are also faculty members of the NTTC and have rich experience in training (Please see annexure).

#### **About the resource persons for the workshop**

Disaster reduction is by necessity a multi-sectoral and multiagency responsibility. No single organisation or discipline can do this alone. Infact, preparedness planning presents excellent opportunities to pool the collective expertise of the several agencies concerned. The invited resource persons included the W.H.O. Representative to India Dr. Olavi Elo, who was formerly Chief, Emergency Preparedness and Response, WHO Headquarters, Geneva, Officials, from the Emergency Medical Relief Division of the Directorate General of Health Services, New Delhi, Centre for Cyclone Warning and Research (Regional Directorate of Meteorology), Madras, The Indian Army and the State Governments of Tamil Nadu and Pondicherry, Representatives from non-governmental agencies (NGOs) such as Community Health Cell, PREPARE and Individuals with first hand experience viz an Ecologist and a Surgeon (Please see annexure-I). All of them presented papers and took part in the discussion.



## INAUGURATION

The Workshop was inaugurated by Dr. Har Swarup Singh, His Excellency the Lt. Governor of Pondicherry. In his address, he referred to the importance of disaster management and preparedness in mitigating the effects followed by natural or man-made disasters.

Dr. Olavi Elo, WHO Representative to India delivered the keynote address in which he reviewed the disaster preparedness and response activities in the North and South American region, Africa and in the South East Asian Region (Keynote address text appears before the scientific papers section).







## KEY NOTE ADDRESS

### PRINCIPLES OF EMERGENCY PREPAREDNESS AND RESPONSE

*Dr. Olavi Elo*

Large-scale *epidemics* of communicable diseases and *natural disasters* such as earthquakes, volcanic eruptions, floods and cyclones as well as drought and consequent famines present a serious and ever increasing threat in many parts of the world. Their death toll and the devastating effects on local and national economies are the worst in the developing countries which can least afford them.

At the same time, both developed and developing countries are facing the increasing threat of *man-made or technological disasters*, caused by traffic, fires, explosions or by accidental release of chemical substances or nuclear contamination into the environment. War and civil strife, both directly and indirectly, also affect large populations.

The national governments and the international community are increasingly aware of the necessity of *preparedness for disasters* as a means of reducing their adverse effects. Through preparedness activities—planning, organizing, training, communicating and educating so as to provide prompt and appropriate response, WHO together with other organizations supports its Member States in preventing and tackling the adverse health consequences of both natural and man-made disasters.

The focus of WHO's support is on *developing* countries. While many developed countries have been able to adjust and introduce effective preventive measures to counter the threats or mitigate their consequences, the developing countries face serious difficulties in introducing such measures which may require considerable resources. Furthermore, the lack of infrastructure and management capacity, as well as communication and logistics problems in developing countries may aggravate the effects of disasters by preventing prompt national and international relief action.

The *linkage between disasters and develop-*

*ment* is evident. Disasters often disrupt development programmes. However, a disaster may lead to the strengthening of the development programmes if, right in the aftermath, due attention is given to the rehabilitation of health infrastructures and health development programmes.

Disasters seldom affect only health. Their main adverse effects are mostly in other sectors. In any event, the corrective action may require means not available in the health sector. Therefore, disaster preparedness and response requires a *multisectoral cooperation* in which only sometimes the health sector plays the leading role. WHO, both in the affected country and internationally, co-operates closely with the other UN, bilateral and non-governmental organizations to provide adequate support, particularly in the health sector.

Efficient disaster response has to be based on the existing local infrastructure and resource that is *integrated* in the regular health programme and infrastructure. In the immediate aftermath of a disaster, community involvement is decisive.

External disaster relief has little effect or may even be counter-productive if it is not adjusted to the assessed needs and local resources. *Appropriateness of relief* is crucial. Too often, unsolicited relief results in waste of resources.

Rapid situation assessment, adequate *information* on existing resources and prompt *communication* are prerequisites to appropriate action. Much of the required information may exist, but is not used or not readily available and needs to be organized. Also, more use could be made of studies on, previous disasters and their management.

*Training, research*, development of training programmes and materials require collaboration with National institutions and International organizations. Sharing of experiences through *technical cooperation* between Member States, together



with WHO and other UN or bilateral and non-governmental organizations, attempts to make the best use of limited resources and will gradually strengthen the capacities of the Member States for disaster response.

It is the above aspects that the WHO programme for emergency preparedness and response is designed to address, in order to fulfill the obligations of the Organizations vis-a-vis its Member States.

## **2. Who's programme for emergency preparedness and response**

### **2.1 The objectives of the programme**

To prevent the health hazards and to reduce the adverse effects of disasters on health or health services, by strengthening national capacities for disaster preparedness and response.

#### **The specific objectives are**

- (a) to promote emergency preparedness and response in the Member States within the health for all strategies for health development;
- (b) to provide timely and appropriate response to emergencies in collaboration with Member States and other organizations.

### **2.2 Approaches of the Programme**

#### **(a) Strengthening of national capacities :**

Member States will gradually establish their disaster preparedness programmes. The key national staff will be trained in the health aspects of disaster preparedness and response. In planning and implementing preparedness activities, Member States will have access to timely, adequate and appropriate technical cooperation with WHO.

#### **(b) Information and communication :**

Disaster information will be improved through efficient use of regular health information and other data sources. Disaster specific information, including rapid situation and needs assessment, and its communication between and within the Member States and WHO will be improved. Studies will be conducted on disasters and their effects on health and health services. Public information will be increased.

#### **(c) Organizational support :**

The national capacities for prompt disaster response will gradually improve. External assistance will be increasingly coordinated by the recipient governments in conjunction with UN and bilateral and nongovernmental organizations. WHO will assume its role among organizations of the UN system in coordinating the health sector emergency response. The technical capacities of WHO together with those of the network of collaborating centres will be fully utilized to provide support to Member States. Cooperation with other organizations will be firmly established.

### **2.3 Coordination :**

WHO emergency preparedness and response activities in the Member States and the regional activities are coordinated within the framework of the global programme. The objectives of the medium-term programme (MTP) as well as targets and the outline of activities for 1990-95 have been approved as part of the WHO Eighth General Programme of Work.

The activities of the global programme include overall coordination of the Organizations emergency preparedness and response activities and cooperation with the UN and nongovernmental as well as with bilateral organizations. While the technical divisions and units of WHO are responsible for the technical contents of the activities, the Unit for Emergency Preparedness and Response (EPR) in the Division for Emergency Relief Operations (ERO) facilitates communication and exchange of information, also promoting development of activities and identification of resources.

### **2.4 International Decade for Natural Disaster Reduction (IDNDR)**

WHO participates in the UN Coordination within the framework of a resolution (A/Res/44/236) by the United Nations General Assembly (UNGA) in 1989, proclaiming the International Decade for Natural Disasters Reduction (IDNDR) which started in 1990. 42nd World Health Assembly in 1989 adopted a resolution on "Fostering the goals and objectives of the International Decade for Natural Disaster Reduction in the Health Sector" (WHA42.16). Following extensive consultation with HQ technical divisions, Regional



Offices and EPR Collaborating Centres, plans for WHO's involvement in the Decade have been prepared, which are expected to enhance the WHO programme development.

## **2.5 WHO Centres for Emergency Preparedness and Response**

In 1988, an agreement signed between the Italian Government and WHO resulted in the establishment of the Pan-African Centre for Emergency Preparedness and Response in Addis Ababa, Ethiopia. It provides services to the African Member States of WHO, both in the Regions for Africa and Eastern Mediterranean.

The Centre has very rapidly established a good reputation and wide contacts so that increasingly it has been delegated a key role in emergency preparedness in Africa. Of particular importance have been the promotional activities such as establishment of a bulletin and a newsletter, and distribution of emergency preparedness literature to the African countries. The Centre conducted its first international course in 1989, and participated in numerous meetings. It works closely with OAU and ECA for political awareness of disaster preparedness in Africa.

In the Region for America, the Regional Programme for Disaster Preparedness and Emergency Relief Coordination has decentralized its activities in three subregional centres which, de facto, have similar and even more extended roles than the Pan-African Centre. In America and Europe, a network of WHO collaborating centres support the Regional and Global programmes. In Asia, thus far there has been a wide gap, which should rapidly be filled.

## **3. Cooperation with other organizations**

WHO cooperates very closely with many UN and nongovernmental organizations. The most important links today are with the following organizations:

### **3.1 UNDRO (Office of the UN Disaster Relief Coordinator)**

UNDRO has a mandate for coordination of international disaster relief. A Memorandum of understanding from 1979 was revised and signed

between UNDRO and WHO on 23 December 1987. WHO provides the health sector technical input including direct advice to UNDRO at headquarters or regional level, in the Member States by the WHO Representatives, and through joint missions to disaster sites or situations.

### **3.2 UNHCR (Office of the High Commissioner for Refugees)**

WHO provided a health and nutrition adviser for UNHCR headquarters until UNHCR established posts for the purpose in 1987. Close cooperation continues, to ensure that common health policies are followed in refugee health operations. A Memorandum of Understanding signed on 23 December 1987 provides a framework for cooperation between UNHCR and WHO.

Joint activities include provision of health coordinators by WHO for the refugee health programmes, technical advice for specific health problems and guidelines and manuals for emergency and refugee health operations.

### **3.3 UNICEF**

Increasing cooperation with UNICEF takes place in the disaster situations, where the organizations attempt to complement each other's capacities and avoid duplication. In the same spirit, constant communication has been established at headquarters and regional level.

### **3.4 Other UN organizations**

WHO provides the health sector direction to UNRWA through the secondment of the Director of Health Services to UNRWA. Sectoral cooperation takes place, for example with UNDP, UNEP, FAO, ILO, and WFP.

### **3.5 Red Cross**

The League of Red Cross and Red Crescent Societies (LRCRCS) and the International committee of the Red Cross (ICRC) are in official relations with WHO. Letters of understanding outlining areas of joint interests and areas of activity were signed with both the organizations in 1987. Joint activities include annual training courses for middle-level managers organized together with



ICRC in three languages (English in Geneva, French in Brussels, Spanish in Sanjose). Again, no such training has been organized in Asia yet.

#### **4. Collaborating Centres**

A network of collaborating centres for disaster preparedness is being expanded for the overall programme support. Thus far, the collaborating centres have been in the developed countries. Gradually, such centres are being identified in developing countries where they should become sources of support for the national programmes and also facilitate technical cooperation between developing countries. Three regional collaborating centres have been approved recently for Latin America.

**The main global collaborating centres include:**

##### **4.1 The Centre for Research on the Epidemiology of Disasters (CRED) at the University of Louvain in Brussels**

CRED supports WHO's activities at the global level. In addition to the development of databases for management information systems, CRED provides technical support in developing rapid assessment methodologies and training programmes.

##### **4.2 The Italian Technical Cooperation**

This collaborating centre provides technical assistance to the Pan African Centre for Emergency Preparedness and Response, particularly focussing on hazard mapping in Africa as well as supporting and monitoring other field activities.

##### **4.3 Center for Emergency Preparedness and Response, the Centers for Disease Control, Atlanta**

CDC has participated in a number of key preparedness and response activities. These include development of rapid assessment protocols. The CDC has also provided technical expertise in assessment of emergency response needs and strengthening preparedness for epidemics.

##### **4.4 FINNPREP, National Public Health Institute, Department of Environmental Hygiene and Toxicology, Kuopio, Finland**

This collaborating centre has supported

WHO's efforts to strengthen country preparedness capacity for technological disasters. FINNPREP has actively participated in preparedness programme development in P.R. China, has given essential technical support to the Rapid Assessment Protocol for Technological Disasters, and participated in organizing workshops on technological disasters in EMRO and AFRO.

#### **5. Who/India collaboration**

Over the years there has been an increasing collaboration at Regional and country levels between WHO and the Government of India. A Regional meeting in 1983 with participation from several countries in South-East Asia took place in Delhi. It was followed by workshops in 1986 in Nagpur, 1987 in Aurangabad and 1989 in Calcutta. In November 1990 and March 1991, two meetings in Delhi have prepared an outline for intensified collaboration, which includes establishment of a network of WHO collaborating centres in India for emergency preparedness and response. Institutions which have participated in these meeting and programme planning, co-ordinated by DGHS, include:

1. All India Institute of Hygiene and Public Health Calcutta (AIIPH&PH)
2. Jawaharlal Institute of Post-graduate Medical Education and Research, Pondicherry (JIPMER)
3. Administrative Staff College of India Hyderabad (ASCI)
4. National Environmental and Engineering Research Instt. Nagpur (NEERI)
5. National Institute of Communicable Diseases New Delhi (NICD)
6. Maharashtra Government

Separate discussions have been held with Postgraduate Institute for Medical Education and Research, Chandigarh (PIGMER) on some aspects of emergency preparedness. In addition, a WHO collaborating centre was established in 1990 at Indian Institute of Technology (IIT), New Delhi for accident prevention. This extensive network of institutions has capacities which complement each other, and would facilitate a comprehensive programme development in India.

These activities are supported by the WHO Regional Programme for Emergency Preparedness



and Response, which has been intensified during this year. An indication of the increasing interest among the SEAR Member States is, that the Technical Discussions at the Regional Committee in September 1991 were on "Disaster Preparedness", and that several countries have, for the first time, allocated funds for disaster preparedness in the WHO collaborative programmes of 1992-93.

Global support for the programme development is available through the WHO collaborating centres, some of which have already participated in the preparatory meetings and provided basic materials. I trust that this collaboration will only intensify once the centres in India get their programmes formulated, and the coordination between the centres gets regularized. Other inter-

national and intersectoral support may be possible through other UN or governmental and non-governmental organizations, and will be subject to discussions in due course.

As a not too distant goal I should like to envisage a situation in which not only the disaster preparedness training, research, information systems and institutional development in India is advanced, but in which these institutions provide a significant input into the WHO global and regional disaster preparedness programmes and, in their turn, support the development in other countries, bilaterally or through Regional and international organizations such as WHO. I would be very pleased if WHO can play a significant role for the achievement of such a goal.



## SCIENTIFIC PAPERS

### PRESENT STATUS OF DISASTER PREPAREDNESS AT THE GLOBAL LEVEL

*Dr. Olavi Elo*

#### 1. Health effects of disasters:

Disasters are considered a public health problem because:—

- a) they may cause an unexpected increase in death, injury or illness in the affected community, exceeding the therapeutic capacities of the local health services and requiring external assistance;
- b) disasters may destroy local health infrastructures, which will therefore not be able to respond to the emergency. They might also disrupt the provision of routine health services and preventive activities, leading to long-term health consequences in terms of increased morbidity and mortality;
- c) some disasters may have adverse effects on the environment and the population, increasing the potential risk for communicable disease and environmental hazards;
- d) disasters may affect the psychological and social behaviour of the stricken community. Generalized panic, paralyzing trauma or anti-social behaviour rarely occur after major disasters, as survivors rapidly recover from their initial shock. Anxiety, neurosis and depression may however follow both sudden and slow-onset emergencies.
- e) some disasters may cause shortage of food and cause severe nutritional consequences like starvation, or specific deficiencies (e.g.: vitamin A deficiency);
- f) disasters may cause large spontaneous population movements, often to areas where health services cannot cope with the new situation, leading to an increase in morbidity and mortality. The displacement of large populations may also increase the risk of outbreaks of communicable diseases both in the displaced and in the host community.

The actual and potential health consequences of disasters do not all occur at the same time

and may vary in importance within a disaster-affected area (Fig. 1). Thus, in natural, sudden onset disaster (earthquakes, floods, etc.), casualties occur mainly at the time and place of impact and require immediate medical care, while the risks of increased disease transmission take longer to develop and are the greatest where there is overcrowding and the standards of sanitation have declined. Some epidemic outbreaks may develop suddenly and last for weeks, while famine situation usually develops slowly over a long period of time.

Table 1 shows some similarities and differences between major natural disasters.

#### 3. Objectives of Health Disaster Preparedness

The objectives of disaster preparedness and response activities in the health sector may be expressed as follows:—

- a) To prevent excess mortality due to the disaster, which may be caused by the direct impact of the disaster, by delays in rescue and relief activities, by lack of appropriate and timely health care, by disruption of the normal health care and break-down of preventive measures, and sometimes by malnutrition.
- b) To provide appropriate and timely care for casualties due to the disaster. These include injuries, trauma and burns in natural disasters; malnutrition in situations of food shortage; acute cases of communicable disease in epidemic outbreaks, etc.
- c) To prevent exposure to adverse climatic and environmental conditions including lack of food, water, sanitation, shelter, clothing, chemical or nuclear exposure, etc.
- d) To prevent short-term and long-term disaster related morbidity:
  - outbreaks of communicable diseases usually due to changes in the local ecological conditions, disruption of



# Prototype Acute Disaster Cycle



Fig. 1



TABLE 1. Comparison among major natural disasters.

Effect	Earthquake	High Wind (without floodings)	Tidal waves/ flash flood	Flood	Drought
Deaths	Many	Few	Many	Few	Moderate
Severe injuries requiring extensive care	Overwhelming	Moderate	Few	Few	Moderate
Increased risk of communicable diseases	Potential risk following all major natural disasters. (Probability rising with overcrowding and deteriorating sanitation)				
Food scarcity	Rare (May occur due to factors other than food shortage)	Rare	Common	Common	Common
Major population movements	Rare (May occur in heavily damaged urban areas)	Rare	Common	Common	Common
Undernutrition/Famine	Occasional	Rare	Occasional	Moderate	Common

(Adapted from PAHO Scientific Publication 438, "Health Services Management following Natural Disaster", PAHO, 1983).

health services, interruption of control measures, lack of sanitation, overcrowding;

- increase in morbidity and mortality due to destruction of health infrastructure and the provision of basic health services;
  - introduction of new diseases due to resettlement or imported by external relief workers;
  - occurrence of wide-spread malnutrition/undernutrition.
- e) To re-establish health services to or above pre-disaster levels, with special attention to:
- reconstruction and repair of damaged health facilities;
  - renovation of health facilities to adequate and appropriate level;
  - reorganization of health services based on Primary Health Care.

#### 4. Preparedness Planning

The *inter-disaster* phase, the time for preven-

tion and preparedness measures as well as training and education of the community, is long before the disaster strikes. This is a silent phase, that may last years. The awareness and interest in disaster planning of the community and of the policy makers greatly depend on the occurrence of recent disasters in the country or in its neighbouring countries. In areas less prone to disasters, it is essential to reinforce and stress information on possible adverse consequences of disasters in order to increase community awareness and interest.

Planning for disasters during the inter-disaster phase is aimed at creating conditions necessary to allow disaster relief operations achieve the following objectives:

- to enable the community to effectively respond to the health consequences of disasters during the initial emergency period;
- to enable the local and the central authorities to organize and effectively coordinate relief activities, make best



*Summary*

use of locally available resources and properly manage international relief assistance.

During this phase, several activities essential for appropriate emergency management have to be undertaken:

- a) *Mapping of potential risks*, for the location of specific possible disasters and their estimated frequency, with the help of a careful analysis of past disasters, geological maps, location of chemical and nuclear plants, location of dwellings, etc.
- b) *Vulnerability analysis*, taking into consideration population density, vulnerable structures, potential environmental hazards, economic aspects, etc. The traditional local coping mechanisms should be carefully evaluated and, whenever possible, included in the preparation of contingency plans.
- c) *Inventory of existing resources*, including physical infrastructure, equipment and personnel, communication, transport, health services, medical stocks, etc., in order to facilitate the rapid mobilization of all available resources during the emergency. The inventory should be frequently updated, including resources available from NGOs, the private sector and the military.
- d) *Planning of appropriate measures*, which include:
  - *Preventive measures*, to prevent or eliminate the occurrence of disasters. Examples of preventive measures in the health sector include immunization against Yellow fever or Measles of the vulnerable population to prevent the outbreaks.
  - *Preparedness measures*, to minimize loss of life and damage, and to organize and facilitate timely and effective relief. Health preparedness measures should be included in contingency plans and frequently tested. Examples include hospital preparedness plans, emergency medical stocks, evacuation plans, etc.
  - *Mitigation measures*, to reduce the vulnerability of the community to a disaster by increasing its adjustment capacity. This includes not only preparedness and preventive measures, but also the

very development activities. The organization of Primary Health Care, the improvement of nutritional status, the promotion of health education, the economic growth, the agricultural development, etc. all contribute to increasing the coping capacity of the population by reducing the vulnerability to disasters, and leading to a decrease in the "disaster threshold" of the local community.

- Development, however, might also mean massive urbanization, uncontrolled industrialization and environmental pollution which sometimes, unless preventive measures are implemented, may become a disaster risk in itself.
- e) *Education and training*, of both the health and relief workers and the public, to encourage local communities to assume responsibilities for emergencies. Institutions, schools, local groups, should all be encouraged to participate in a continuous education and information effort in order to reach all the target population in a consistent and continuous manner.

## 5. Implementation of Plans

### a) Pre-disaster phase:

The time for warning, protective actions and possible evacuation of the population is just before the disaster strikes. The effectiveness of protective actions will largely depend on the level of preparedness of the population particularly at the community level.

Action during this period includes:

- *Early warning*, based on prediction of the impending disaster. Unfortunately not all disasters are preceded by preliminary signs and even when these are present, the decision to issue a warning is often a difficult one. To issue a warning too early means losing credibility in case nothing actually happens, while doing it too late may not allow enough time for the implementation of protective measures. The community must be prepared to understand and react to the warning. Early Warning Systems have



been developed and tested for cyclones, floods and nutritional emergencies, while epidemiological surveillance systems can often predict epidemic outbreaks.

- *Implementation of protective measures*, on the basis of the preparedness and contingency plans. Hospital emergency plans should be activated and assistance organized according to the expected emergency. Sudden natural disasters often do not allow enough time for the implementation of protective measures. In long-term disasters or when an early Warning System is ineffective, protective measures will depend on the awareness and preparedness of the community, of the local authorities and of the health staff.

b) *The impact phase*

The moment the disaster strikes is the time for destruction, injury and death. This may last a few seconds as is the case of earthquakes, or days or weeks as is the case of floods and drought. The effects of the impact on health vary widely according to several factors, such as the nature of the disaster itself, population density, pre-disaster health and nutritional status, climate, organization of health services, etc.

c) *The emergency phase*

Immediately after the impact is the time for rescue, relief and assistance to the victims. In the immediate post-impact period the local community is isolated (isolation period) and many of the most pressing rescue tasks are accomplished by the survivors themselves with the locally available resources. The existence of district and community preparedness plans greatly increases self-reliance and effectiveness of assistance, contributing to the reduction of disaster-related mortality and morbidity.

However, since disaster exceeds, by definition, the adjustment capacity of the affected community, external assistance remains necessary (relief period). During this period, assistance from inside and outside the affected country starts to reach the

disaster area. This is also called the "convergence" phase. The assistance should be appropriate to the needs, avoiding duplication of efforts and waste of resources. Effective coordination is essential during this period.

During the emergency phase, effective management of the victims will depend on the preparedness of local health facilities and on the adequacy of external aid.

d) *The rehabilitation phase*

The relief phase should lead to rehabilitation, reconstruction, rebuilding and restoring of pre-disaster conditions. Initiatives towards rehabilitation should start immediately after the impact phase and gradually increase during the emergency and reconstruction phases. Rehabilitation can lead to improvement of health infrastructure and health conditions of the affected population, linking disaster to development.

Following a disaster, the pattern of health needs will change (rapidly in sudden natural disasters, more gradually in famine or refugee crisis) from casualty management towards primary health care. Priorities will shift from health care to environmental health measures and epidemiological surveillance.

Three main areas of assistance must not be overlooked following health emergency operations:

- long-term problems caused by the disaster, including the extended need for medical care for some victims, the surveillance of communicable diseases and care for the orphans;
- re-establishment of normal health services, taking into consideration the opportunity for making major changes in health care provision;
- assessment, repair and reconstruction of damaged facilities and buildings.

The reconstruction phase following a disaster should lead to the restoration, or, if possible, amelioration of pre-disaster conditions. The rehabilitation measures and their effects on the long-term global development of the affected community



should be carefully considered. Too often measures decided in a hurry tend to obstruct further re-establishment of normal living conditions. However, disasters can also have positive effects in the long run and be considered as an opportunity for development. The additional resources available, the new attitudes and cohesion developed by the community and the strengthening of operational capabilities at all levels can all be used to accelerate the development process of the affected country.

The reconstruction period is also *the* time for thinking about the lessons learnt and develop preparedness plans on the basis of the newly acquired experience. This is the beginning of another inter-disaster phase.

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*Add material from INPF booklet*



# CONSIDERATION OF ENVIRONMENTAL ISSUES TOWARDS LONG-TERM DISASTER PREPAREDNESS

*V.M. Meher-Homji*

First of all a word is necessary to explain the presence of an humble ecologist among learned savants of medical profession.

Disasters are often linked with natural phenomena like floods and droughts, which affect the population both directly and indirectly. Diseases like cholera, diarrhoea, dysentery and malaria may follow floods and water-logging; the aftermath of droughts is starvation. Whereas the medical profession has to ensure preparedness to cope up with these health problems, the environmentalist has to plan an advanced long-term strategy to see to it that drought is not followed by a famine or that the land-use is adjusted to the fury of storms. If the region is drought-prone, the cropping pattern should be geared to limited water supply, with suitable fruit trees meeting the food requirements. As the human health is essentially related to nutrition and to the quality of water, air and land, the well-being of the environment is one of the prerequisites for the fitness of mankind.

Environment is often equated to pollution and the health hazards of pollution are too well-known.

The pollution issue may cover the entire spectrum ranging from tobacco-smoking to a tragedy measuring up to the scale of Bhopal gas leak catastrophe or Chernobyl nuclear calamity, all of which call for preparedness. However, these are not such pollution-linked environmental issues that I am going to address here. Nor am I going to deal with the carcinogenic agents that eventually enter into the orbit of disaster.

I would essentially deal with the natural disasters, which of course often get accentuated by man's activities. Disaster may strike in a flash like floods or may be a slow creeping, crippling process like desertification or global warming (Fig. 1). So let us first of all consider climatic calamities like cyclones and floods which are one side of the coin, the other side being droughts and desertification.

Now that there are powerful tools like the satellites, the meteorologists can predict cyclones, storms and sea surges sufficiently in advance and sound alarm warnings for evacuating people from the threatened zone. Yet the havoc wrought by the cyclones in Bangladesh recently is fresh in our mind. Not that the cyclonic activity has increased in recent years, the tidal waves were there in the past too, but the damage caused by these was much less because the shoreline was protected by a dense cover of tidal forest or mangrove. In the absence of the latter, the cyclones attain catastrophic proportions. The restitution of the original forest-cover is called for to reduce the fury of the natural disaster.

The Department of Science and Technology, Government of India, under the leadership of its Secretary Dr. Gowariker has evolved an efficient system of monsoon forecasting. However, monsoon and rainfall are not synonyms. Rainfall can be of different origin: S.W. monsoon is a phenomenon depending on the moisture bearing winds blowing from the Arabian Sea and the Bay of Bengal; its success depends on the right type of sea surface temperature and pressure. In the normal monsoon years, it is the Indonesian-Malaysian region which experiences high temperature and low pressure which promote a good monsoon current in India but in the abnormal years, called *El-Nino*, it is the Pacific region, off the coast of Peru, in South America which is under high temperature and low pressure. Then the S.W. monsoon is a failure in India.

What we call N.E. monsoon is in fact a system of depressions and cyclones formed in the Bay of Bengal which bring rains to the coastal regions of Coromandel and Circar. Then we have orographic rainfall due to mountain effect and finally there is the convectional type of rainfall, wherein pockets of land get excessively heated. A dense forest cover is capable of generating rains of convective origin. This is conclusively proved in the Amazon basin



# REPERCUSSIONS OF DEFORESTATION ON ATMOSPHERIC AND SOIL PROCESSES

## A graphic scenario

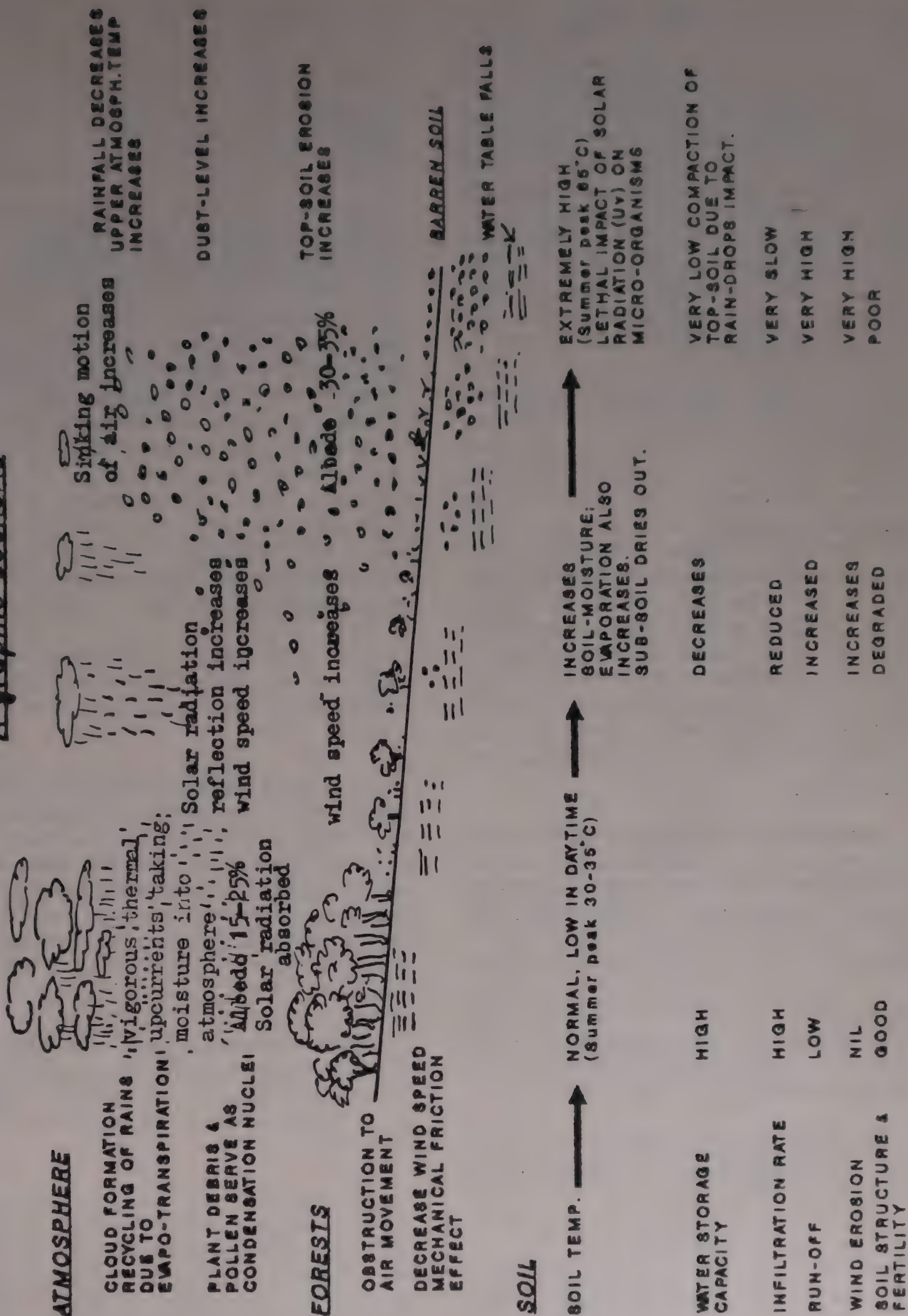


Fig. 1



of South America. The original source of moisture into the basin is from the Atlantic Ocean. The very structure of the basin with plateaux to the north and south and the high Andes wall in the west is such that all the moisture remains trapped within the basin. Moisture evaporated from the soil and transpired by the leaves of the dense evergreen forest helps recycling of the rain water. This may be happening even in the Western Ghats but no experiments have been carried out so far. 1987 was a drought year. There was shortage of water in Southern India but the now well-known Silent Valley forest area was regenerating its own rains through convective process.

Then, creation of green belts using our own indigenous trees could go a long way in mitigating water-shortage problems. The role of indigenous trees is to be stressed because the exotics like *Eucalyptus* and Australian Acacias are basically Xerophytes, tending to reduce water loss through transpiration. In *Eucalyptus*, the leaves are drooping and covered with wax. In Australian Acacias, what appears as leaf is in fact the leaf-stalk or petiole, an adaptation to minimise water-loss. *Eucalyptus* may be taking up a large quantity of water from the soil but it stores it in its trunk producing rapid growth with soft wood. Indigenous trees tend to produce harder wood with slower growth; the water loss through transpiration could be considerable.

Pondicherry has a very erratic régime of rainfall. Some years the rainfall is on a very low side, hardly 600 mm are received per annum; some years the rainfall quantum may be three to four times higher. The average rainfall of 1200 mm is seldom realised as we remain between low or high rainfall years. The reason is that Pondicherry region depends mainly on the N.E. monsoon. Some years the frequency of depression formation is low, then the rainfall is meager. In other years many depressions are formed and the rainfall is higher.

By way of long-term preparedness to deal with the drought years, growing of suitable fruit trees may be advocated.

India imports cloves to the tune of crores of Rupees. The clove tree (*Eugenia caryophyllata*) needs a rainy climate, which Pondicherry does not have. However, experiments should be tried to

graft the branches of the clove tree on its close "Cousin", the Jambol tree (*Eugenia jambolana*, synonym *Syzygium cumini*), which is very common in our region. The best varieties of mangoes are obtained through grafting, and the kind of graft suggested above could be a measure towards drought disaster preparedness for the farmers.

Now let us look to the water problem. We in Pondicherry entirely depend on the ground-water. Excess of pumping leads to the infiltration of sea-water into the aquifers. The problem could attain severe form, if no steps are taken now. Auroville has set a good precedence combining plantations with bunding. The rain water is thus not allowed to run-off but is made to percolate into the soil, recharging the water-table. Elsewhere, over most of the red ferrallitic (lateritic) plateau of Pondicherry, the rain water rushes to the sea, carrying soil particles with it. After every shower, 50 to 100m of the sea turns red. This is a red danger signal indeed. Soil erosion is acute, ravine-formation process is intensified and the rain-water does not get a chance to recharge the water-table.

The earlier maps of Pondicherry show a number of percolation ponds which are to-day either silted up or encroached upon. The situation is serious.

India has a long coastline of over 6000 kms. Dew during winter months is of common occurrence in the coastal areas and Pondicherry is no exception. Cashew nut trees drip water during winter mornings as if sprayed by a sprinkler. The natural vegetation does not suffer from dryness even during low rainfall years. For these species of the natural forest, dew is an important source of moisture.

In the Sinai desert, grape was cultivated by the Palestinians using dew. The fruit of Grape which contains more than 99 per cent water could be grown even in the desert. We need special technology to harvest dew.

Also we allow used water to run to waste. Now technologies are available to purify sewage water using plant species. I am happy to learn that the *Volontariat* organisation of Pondicherry has taken a lead in this matter and will be taking up two sites on an experimental basis for sewage water



purification,—one in Pondicherry and the other in Auroville.

The threat of increasing content of carbon-dioxide in the atmosphere is looming large on the horizon. The aftermaths are global warming and rise in sea-level. These are hanging over our heads like the proverbial Sword of Democles. The melting of glaciers and polar ice caps could submerge the islands and coastal belts. Fertile fields could be rendered wastelands with an invading salinity. We have to be prepared to face such a situation. The mangrove vegetation could come to our rescue. Once considered as a wasteland, mangrove species could provide suitable salt-tolerant genes for crop plants. In the Sundarban flourishes a salinity-tolerant species of wild rice (*Oryza coarata*).

Through a suitable gene-transfer biotechnology, the genes could be transferred to our commonly cultivated rice species *Oryza sativa*. Dr. M.S. Swaminathan's Research Foundation in Madras has taken up important projects on this aspect to enable mankind to face the challenge posed by natural disaster activated by anthropogenic activities.

In conclusion, it should be our endeavour to maintain our systems in a sustainable state. What is not sustainable becomes vulnerable in course of time. Three degrees of fragility may be recognised. The first step is the vulnerable status of a species or a system. Second is the threatened or the endangered state and the final step is the extinction of a species or the total collapse of a system.



# DISASTER PROFILE IN INDIA AND DISASTER PREPAREDNESS AT THE NATIONAL LEVEL

*Dr. Brij Bhushan*

India is geographically situated between latitudes 8.4°N and 37.6°N, longitudes 68.7°E and 97.25°E. The tropic of cancer passes through the middle of the country. The snow covered Himalayas constitute the northern border and the peninsular region is bounded by the Arabian sea on the west and the Bay of Bengal on the east.

India is the second most populous country in the world. The total population was 843,930,861 according to 1991 census.

## **Physical Environment**

The mainland area consists of 3,287,782 sq.km. and comprises three well-defined regions: the Himalayan mountain system in the north; the great plains of the Ganges and Indus rivers; and the plateaus of the peninsula.

India is subject to natural disasters of a variety of types. The country's physical features have an important effect on weather patterns. The Western Ghats, for example, obstruct the southwest monsoon so that the rainfall is heavy on the coastal region west of the Ghats, while peninsular India to the east receives low rainfall and is an area of chronic drought. The Himalayan mountain system, though largely outside of India, is the source of India's great river systems and acts as a barrier to cold winds from the north and to the monsoon air-flow from the south. Because of continuing uplift movements in these mountains, the region is susceptible to earthquakes.

Deforestation in parts of the Himalayas has been linked increasingly with the problem of flooding. All of India's river basins, including the Himalayan rivers, the rain-fed Deccan or peninsula rivers, and the coastal and the inland drainage rivers are subject to flooding; however, flooding is most common in the lower Ganges River Basin and Brahmaputra. The flatness of the terrain in most of these Indo-Gangetic Plain, coupled with silt ac-

cumulation in rivers due to erosion, prevents rapid drainage during periods of heavy rainfall.

The country is heavily dependent on unstable monsoon rains for moisture, particularly the southwest monsoon which covers much of India between June and September. Inundation of the flood plains is expected annually, but extreme conditions are not uncommon. Prolonged and heavy rainfall may cause disastrous flooding, while poorly distributed monsoon rains of below normal volume may result in crop failure and food scarcity. Drought is chronic in some areas but has occurred in nearly all parts of the country with failure of the monsoons. Tropical cyclones and accompanying storm surges are an annual menace during the onset and the retreat periods of the southwest monsoon. The east coast is most frequently affected.

## **Disaster Profile**

There have been many efforts to define the word disaster none of which is entirely satisfactory. They are either too broad so that trivial events might be included or too narrow so that exceptions could easily be found. Therefore no effective formal definition is possible. The term disaster is often used to cover such desperate events as war, industrial accidents, blizzards, avalanches, volcanic eruptions, earthquakes, fires, famine and many types of windstorms and floods, events which have little in common except for their destruction.

**Disasters are often classified into two groups:—**

1. *Natural*
2. *Man made*

They are sometimes sub-divided again into those of slow and sudden onset. These headings are descriptively convenient but do not form a classification of either immediate causes or the effect of different agents on the communities.

Some types of disasters such as fires may be



natural or man made. According to the circumstances some sudden onset disasters such as floods may occur rather slowly under some conditions and the slow onset disasters of famine may occur suddenly when there is abrupt termination of food supply to a part of population due to one reason or the other.

As Sociologists have pointed out, natural events such as earthquakes and floods are not intrinsically dangerous. It is the relationship between the natural agents and the people that make them so.

#### **A few definitions of disaster are as under:—**

1. A disaster is an overwhelmingly ecological disruption occurring on a scale sufficient to require outside assistance.
2. A disaster is an event located in a circumscribed time and space which produces conditions whereby the continuity of the structure and the process of social units become problematic.
3. A disaster is an event or a series of events which seriously disrupts normal activities.

### **Hazard Analysis**

#### **Drought**

The drought is one of the worst natural calamities that has affected India on many occasions. The most important cause is the deficiency of rainfall. India being an agricultural country it depends on the rainfall of South-West Monsoon (June to Sept.). During this period the country gets about 75% of its rainfall. Any large deficiency of monsoon rainfall in sizable parts of the country therefore brings disasters. The rainfall shows considerable year to year variability over the country as a whole and also over the regions like North-West India and Peninsular India.

#### **Prediction of drought**

Drought prediction still remains an unsolved problem. Indian Meteorological Department is, however a pioneer in issuing long range forecast of monsoon rainfall and is doing so for the last several years.

The country has a geographical area of 329.3

Million Hectares, of which, the *arable* area constitutes about 140 Million Hectares. The distribution of the sown area under the various ranges of rainfall is as under . .—

- a) 33% Low rainfall region (750 mm)
- b) 35% Medium rainfall region (750–1125 mm)
- c) 24% High rainfall region (1125–2000 mm)
- d) 8% Very High rainfall region (2000 and above)

Because of the erratic behaviour of rainfall, even the medium rainfall region is vulnerable to drought conditions. Consequently 68% of the sown area is drought prone.

Over the years we have evolved a comprehensive drought management approach which is capable of mitigating the disaster. The 1987 drought management demonstrates the soundness of this drought management system.

Rainfall data is collected regularly by IMD through its network of about 4,000 rain gauges and by the state government through an extensive network of rain gauges located at district and sub-district levels.

The drought management strategy comprises of measures to mitigate the disaster impact and provide relief. Water budgeting helps in providing life saving critical irrigation to drought affected crops and reduces the fall in agriculture output and also ensures drinking water for cattle and human population. The main objectives of relief programmes are to provide:—

- food security to the affected population.
- income distribution through massive employment generation programme.
- nutritional supplementation to the vulnerable sections of the society.
- effective health cover to human and animal population.

A comprehensive crop insurance scheme provides financial support to the farmers in the event of crop failure. Supply of subsidized agricultural inputs and provision of agriculture credit under relaxed criteria are measures designed to sustain the agricultural activities in the succeeding monsoons.

Despite such a sound drought management



system in the country still the following areas need improvement.

- i) The damage assessment methods, consequently the logistic planning for drought management needs further improvement;
- ii) At present, an employment generation programme is launched to create durable assets which will enable the people in the area to withstand drought battering futurers and to provide employment to the drought affected population. As the employment opportunities have to be provided within 5 kms. of the habitation of the affected population, productive works have to be found and executed within the stipulated districts. However, in the chronically drought affected areas, it has not been possible to provide employment which is drought proof. As this employment has to be given within stipulated areas of habitation the State Governments resorts to undertake works which are of very limited value with regard to drought proofing. Hence there is a great need to evolve an alternative employment strategy. Its theme should be "Living with drought".
- iii) In the arid zone and semi-arid zones of Rajasthan, Gujarat and Rayalseema of Andhra Pradesh drought is more or less a permanent feature. In these areas development programmes which are least dependent on rainfall have to be evolved.

## Floods

Floods occur during monsoon. A combination of heavy spells of intense precipitation during monsoon, tropical storms and depressions results in flooding of over 8.5 Million Hectares annually in the country. Deforestation in catchment, inappropriate land use and degraded lands, inadequate capacity of drainage channels to carry the peak flow and extensive human occupation of the flood prone plains aggravate the damage caused by the floods.

The Central Water Commission has developed a plan for proper use of flood plains in order to minimize the human loss and property damage which is shown in the diagram. (Fig. 1)

But in a democratic set up we can not force people not to live and cultivate the fertile flood plains because it adds to their income. People occupy flood plains because pressure on land is much and we require more and more arable land. Therefore people start using these plains and in due course during the floods face their fury. We can only suggest the ways and means of properly using these flood plains.

Presently, a National network of 157 Flood Forecasting and Warning Stations Set-up is maintained on 62 River basins. Immediately after the monsoon seasons every year, the various field divisions and regional organizations as also the Central Water Commission's Hqrs and the Flood Control Coordination Unit under the River Management Wing evaluate the performance of the individual network stations by comparing the forecasts vis-a-vis the actual incidents in order to identify the measures to further improve the accuracy in future performance.

*(Map of India showing 157 FFC Stations along 62 River basins Fig.2).*

Now we are in a position to manage the situation created by floods with minimum number of deaths and damage.

While death toll to human lives has been reduced to a significant extent, the economic loss due to disaster is on an increasing trend. The average loss due to floods was in the order of Rs. 105 crores in 1960s which increased progressively to 2000 cores in 1990s. The extent of flood damage in India from 1953 to 1990 is shown in Fig.3.

A Flood Control Commission analysis showed that there had been a five fold increase in total damage in later seventies as compared to the 15 years period of 1950 to 1965. In recent times damage to houses and public utilities continue to share a higher proportion of damage value.

The following suggestions are made by the National Flood Commission for the improvement of the situation.

- i) Involving scientific methods of flood damage assessment.
- ii) Undertaking preparations of hazard analysis and vulnerability analysis of flood prone areas.



# PROPER USE OF FLOOD PLAINS

## LEGEND:

- PROPERTY LINE
- ~ STREAM
- - - FLOOD PLAIN LIMIT
- ▨ PUBLIC RECREATION LAND

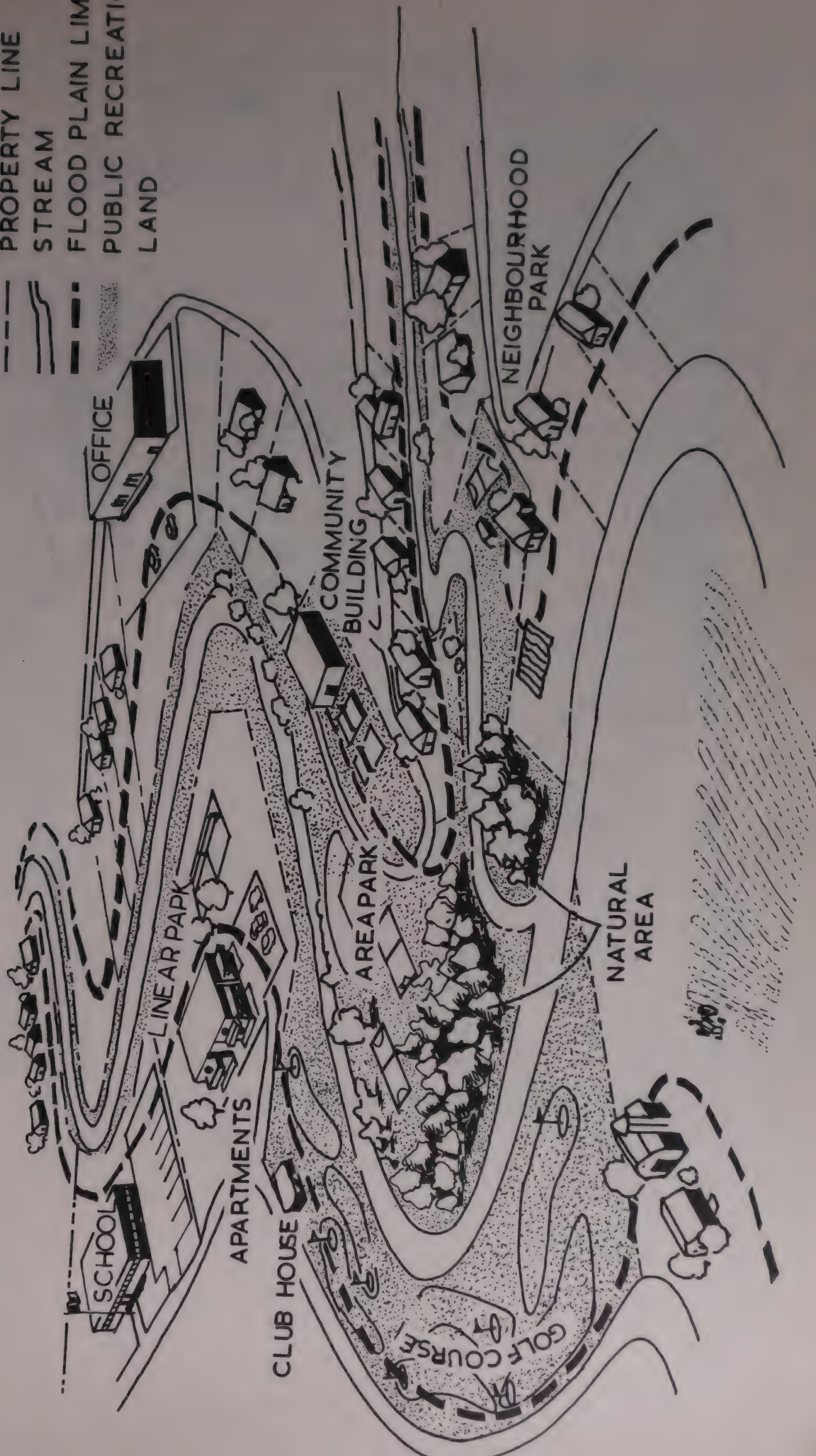


Fig. 1



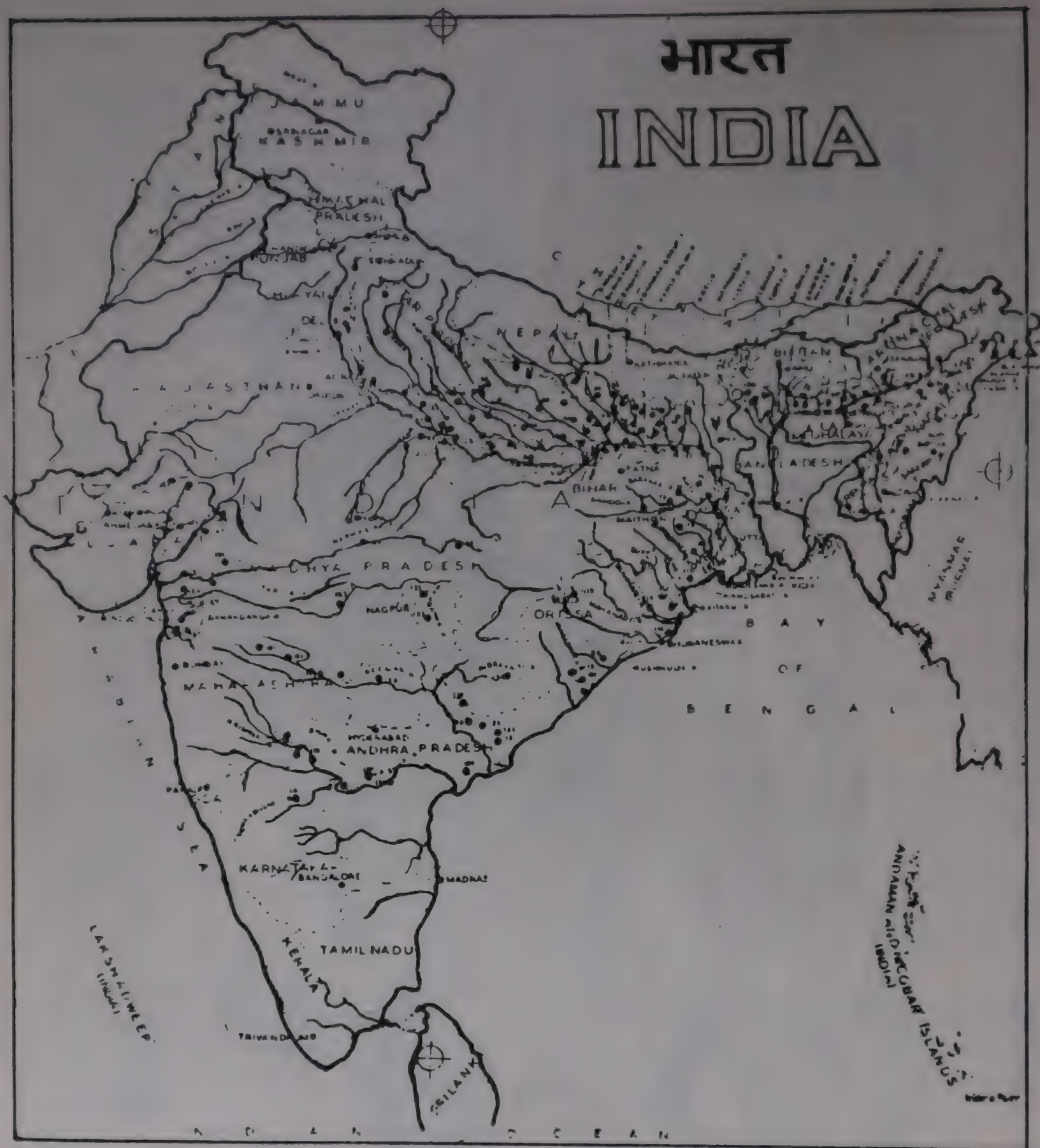


Fig.2 FLOOD FORECASTING SET UP -1990



# FLOOD DAMAGE IN INDIA 1953 - 1990

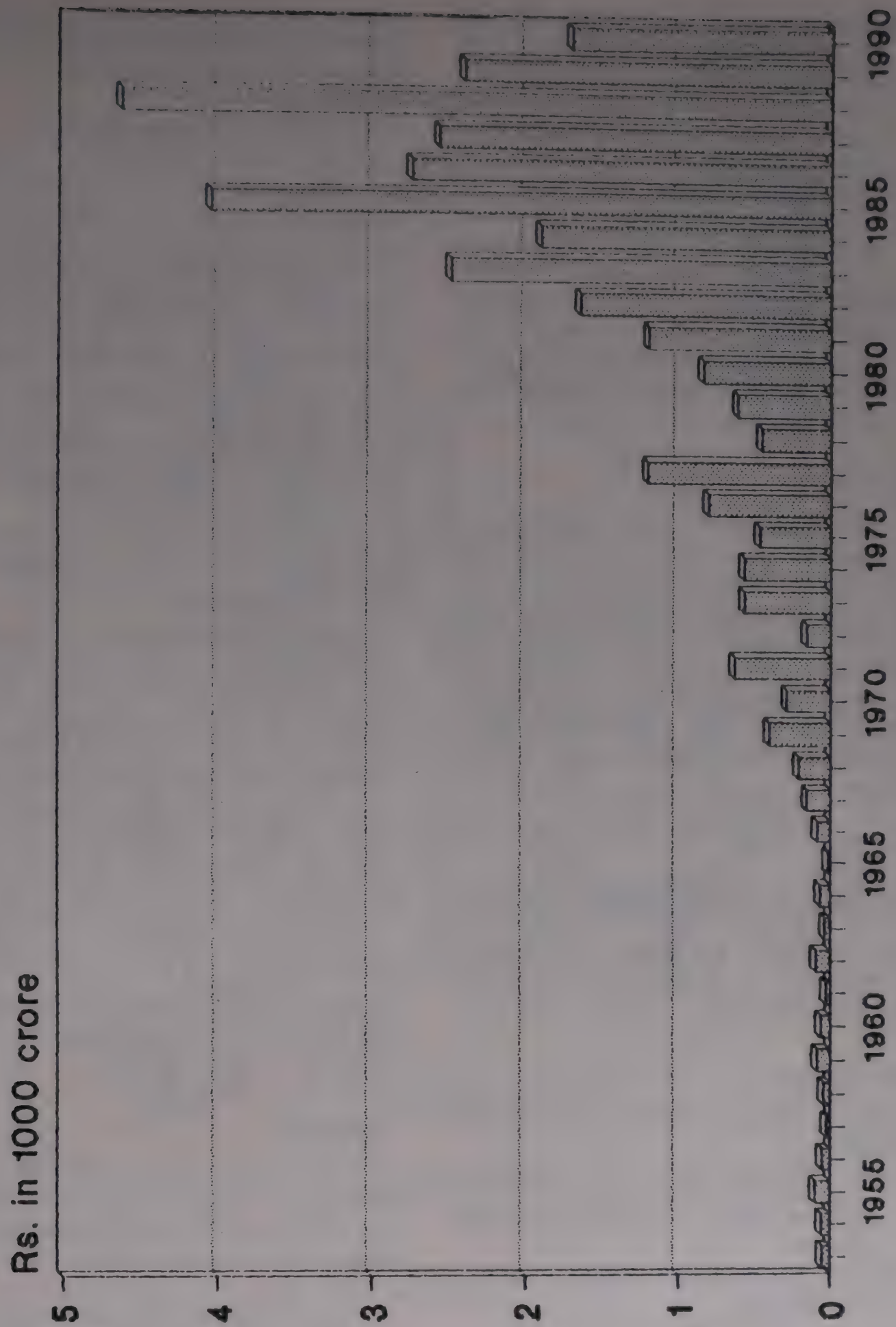


Fig. 3



- iii) Development of land use planning with proper regulation of development activities in flood zones.
- iv) Development of contingency crop planning for minimizing the crop loss for flood prone regions.
- v) Identification, construction of flood resistant houses in order to give permanent protection to the people living in flood prone areas.
- vi) Implementation of long term plans for basin areas, including afforestation programme to moderate flood flows and a development of drainage system in command areas.

## Cyclones

Tropical cyclones, at times, bring nature's worst disasters in tropics. India bring slightly away from the equator within the belt of tropics (between 30 deg. N and 30 deg. S), their frequency, intensity and coastal impact vary from place to place. The frequency of tropical cyclone is less in the Arabian sea and more in the Bay of Bengal and when the cyclone crosses the latter coast it plays havoc. This is because of the serious storm surge problem in the area.

### *Cyclone warning system in India*

At present the cyclone warnings are provided through the Area Cyclone Warning Centres located at Calcutta, Madras and Bombay and Cyclone Warning Centres at Bhuvaneshwar, Vishakhapatnam and Ahmedabad.

## Cyclone Tracking

In India, tropical cyclones are tracked with the help of:—

- i) Regular observations from weather network of surface and upper air observing stations.
- ii) Ship reports cyclone detection radars.
- iii) Satellites and
- iv) Reports from Commercial Aircrafts.

A network of 10 Cyclone Detection Radars has been set up along the Indian Coast. Six of them are located at Calcutta, Paradip, Vishakhapatnam, Madras, Machilipatnam and Karaikal

on the east coast while four are at Goa, Cochin, Bombay and Bhuj on the west coast. The Range of these Radars is 400 km. (Fig.4).

### *Dissemination of Cyclone Warnings*

Warning to the State Govts. is issued in two stages. In the first stage a cyclone alert is issued normally 48 hours before the commencement of adverse weather along the coast. A cyclone warning is issued about 24 hours before it strikes the coast. Port and Fisheries warning start much earlier. These warnings are disseminated through:

- i) Land line telegrams on special high priority.
- ii) Repeated broadcasts through All India Radio in different languages.
- iii) Bulletins through the press.
- iv) P & T Department Coastal Radio Stations.
- v) Telephone, Telex and Teleprinters and
- vi) Wireless network of Police.

With the improvement of forecasting and warning systems and disaster preparedness strategies it has been possible now to minimize the impact of the cyclone. A comparative account of the severe cyclones of 1977 and 1990 which hit Andhra Pradesh coastal area reveals the fact that over a decade a sound disaster preparedness system including effective forecasting and warning system has been evolved. While the 1990 cyclone was comparable in terms of wind speed and the height of strong surge to that of 1977, the death toll was restricted to less than 1000 in May 1990 whereas 10,000 lives were lost in 1977 and 6.57 lakh people were evacuated in 24 hours and the ratio of death toll and the affected population came down significantly.

## Earthquake

The country has about 56.6% of its total area as vulnerable to seismic activities of varying intensity. This is located essentially in the Himalayan Region besides the Andaman & Nicobar Islands.

As no prediction with regard to any impending earthquake is possible, the disaster management of earthquake is confined to post disaster relief operations only.

Contingency plan exists for initiating relief



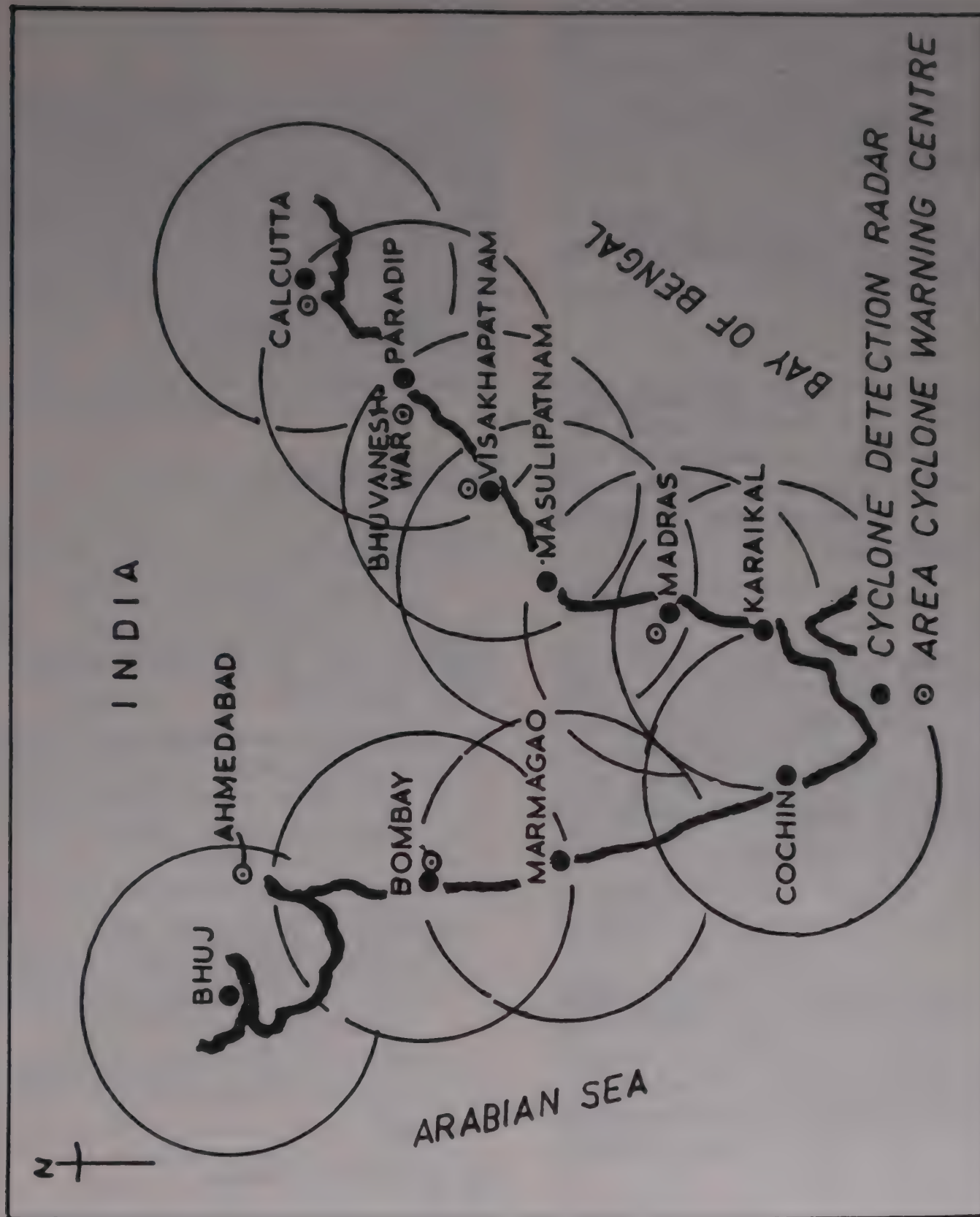


Fig. 4 CYCLONE FORECASTING SET UP IN INDIA



measures immediately after an earthquake. The department of earthquake engineering, Roorkee has evolved a guideline to strengthen buildings against seismic activity of various magnitude.

IMD is the nodal agency in India for monitoring earthquakes. 56 seismic stations and 32 seismic observatories in different parts of the country are engaged in the task of monitoring. Arrangement also exists for monitoring seismic disturbance in some identified reservoir/dam sites.

India was the first country to prepare an Earthquake resistant building construction code IS 4326 in 1967, revised in 1976.

### **Landslides**

Landslides are frequent and recurrent in various regions of India. They are triggered off by natural causes like heavy rainfall, sudden cloud burst and land soil degradation caused by human interference. The Himalayan region has very high incidence of Landslides.

### **Avalanches**

About 25000 Hectares of the country, mostly in the Himalayan region fall in the Alpine region. The snow avalanches here are massive and have great destructive potential. Most of these are direct action types occurring during the period of the heavy snow fall or immediately thereafter. Wet snow avalanches during spring are also very common.

### **Volcanicity**

India has no active volcanoes. Barren islands in the bay of Bengal (East of Andamans) is a dormant volcano which erupted, last in the early 1800's. The island of Nocodam, 150 km N.E. of Barren island is considered to be an extinct volcano, but in 1990 minor eruptions were noticed and investigations are in process.

### **National Policy**

Government response and efforts sets the pace and determine the quality of a society's reaction to a crisis situation resulting from a natural calamity. In the federal setup of India the responsibility to

formulate this is essentially that of the concerned State government, the Central government supplements to the extent possible by way of providing financial and material assistance for effective management of the situation in accordance with the existing schemes of financing the relief expenditure.

Successive finance commissions have also reiterated this position that the States are primarily responsible for relief activities, while the Central government associates itself with the measures aimed at *ameliorating* the sufferings of the people. The dimension of the response at the level of the national government are determined in accordance with the existing policy of financing the relief expenditure and keeping in view :

- a) the gravity of a natural disaster and
- b) the scale of the relief operations required.

### **Type of Response**

#### *a. Policy Response*

The policy response to a natural disaster would be provided by the Prime Minister, Cabinet committee and the Agriculture Minister. The objective would be :

1. To empathize with the sufferings of the people affected by the natural disaster.
2. To subserve long term and short term policy objectives of the government.

*The policy response of the center leads to the :*

1. Visits to the disaster affected areas by President, PM, and other dignitaries.
2. Activation of the administrative machinery for assisting in the relief measures.
3. Setting up a machinery for implementing, reviewing and monitoring the relief measures.

#### **B. Administrative response**

The response of the administration to a situation arising out of natural calamity would be on :

- 1) a follow up of a policy objective of the Government.
- 2) State's request for central assistance.



- 3) an assessment of the situation for the central response, and
- 4) the information about the extent of damage suffered by the State due to disaster.

#### **Scarcity relief division:**

For ensuring appropriate policy and administrative response to natural calamity, a clear identification of the nodal organisation and the pattern of interaction between the different Government departments would be necessary. Therefore the department of agriculture and cooperation in the agriculture ministry is designated as the nodal department for all matters concerning natural calamity relief. In DAC, relief commissioner, who is of the rank of additional secretary functions as the nodal officer to coordinate relief operations. The organisation chart is given below.

A control room is operating in the Ministry of Agriculture and Cooperation round the clock. An under secretary is designated as the Officer-in-charge of the control room with a telephone (No. 384555 and telex (No.031x65054-Agri-IN).

After getting information of any disaster it transmits the information to the following officers viz the Secretaries to the President and Prime Minister, Personal secretaries to the Minister for Agriculture and the M.O.S. for Agriculture, Cabinet Secretary, Secretaries for Agriculture, Rural Development, Water Resources, Power, Civil Defence, Civil Supplies, Health, Communication, Surface Transport, Science & Technology, Home, Defence, Food and I & B, Relief Commissioner, Joint secretaries for Agriculture, Planning Agriculture Commissioner and the Commissioner (Animal Husbandry).

Every Department/Ministry of the Central Government which is involved in the process designates an officer not below the rank of a Joint Secretary as a nodal officer with an alternative as well, for dealing with all matters concerning natural disaster and he is responsible for formulation of detailed action plan of that department.

#### **Cabinet committee:**

The Cabinet sets up a committee and the Agriculture secretary provides all the necessary information and seeks direction if any of the cabinet

committee in all matters concerning relief operations and takes steps for effective implementations of its directions. In the absence of such a committee he reports direct to the Cabinet secretary.

Under the cabinet committees there is a national crisis management committee (NCMC). Its composition is given in Fig.5.

Under the NCMC a crisis management group (CMG) is constituted in the Ministry of Agriculture. Its composition is given in Fig.5.

Normally the CMG meets twice in a year in the months of Dec./January and May/June. It meets daily during the time of crisis. It takes stock of the situation, coordinates the activities of the central government departments involved in the CMG and maintains information regarding the steamer.

#### **Calamity relief fund:**

The present scheme of financing the relief expenditure arising out of natural calamities has come into force with effect from 1/4/90, consequent upon the acceptance of the recommendations of the Ninth finance commission. Under this scheme a CRF is constituted for each state with certain amount allocated to them. 75% of this amount is contributed by the central government and given to the states in 4 equal instalments. The balance of 25% is provided by the State government from its own resources. Following the constitution of CRF it is the responsibility of the concerned State to meet the expenditure meant for calamity relief unless and until the crisis is of rare severity in which case Govt. of India examines the case and if found deserving, additional funds are given to the State (annexure IX).

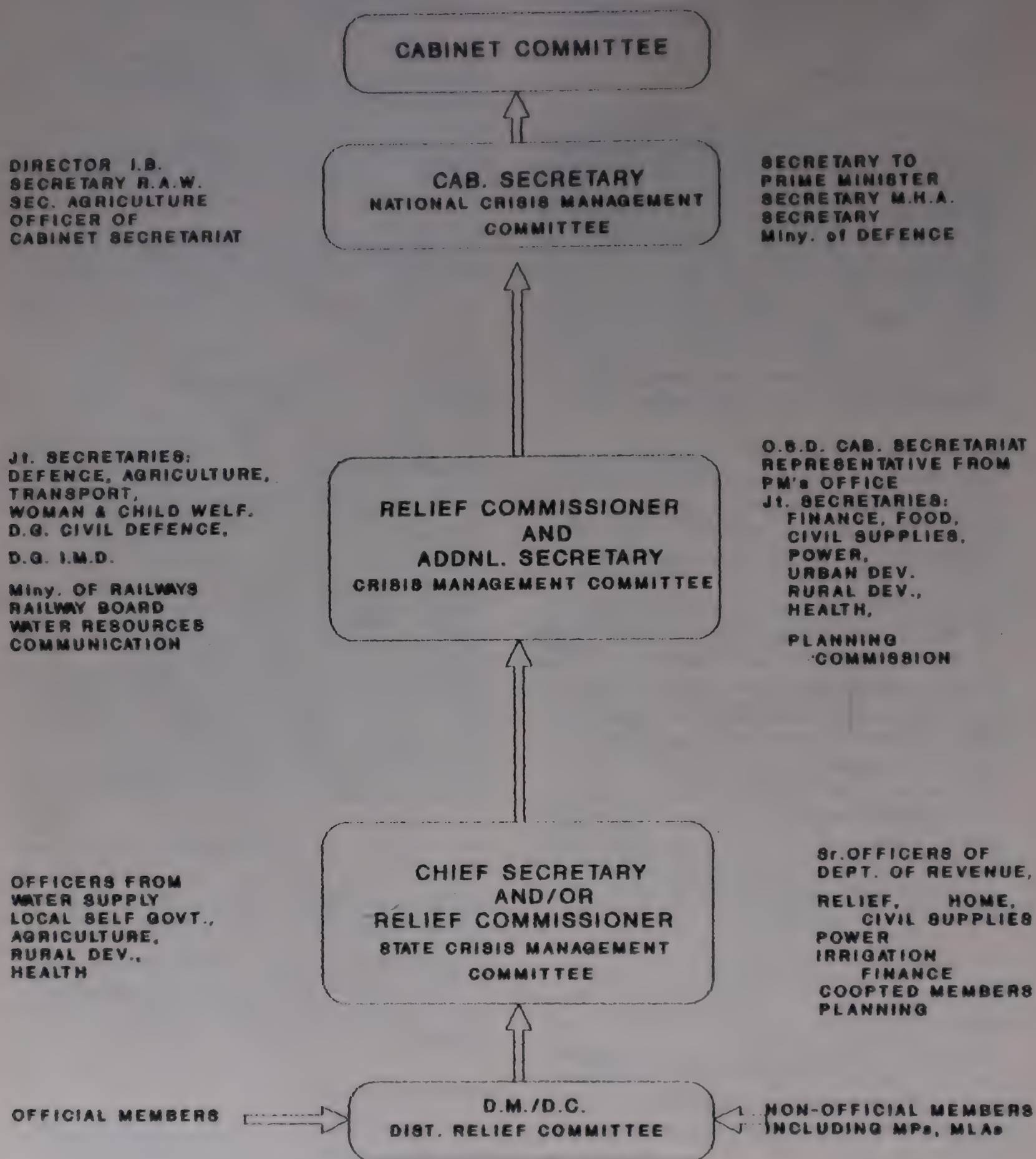
An expert group has been constituted on the recommendations of the ninth finance commission to monitor the relief work done, and the utilisation of CRF.

#### **State level response:**

There will be a state crisis management group (SCMG) under the chairmanship of chief secretary/relief commissioner. The composition is given in Figure 5. The SCMG will take into consideration the instructions and guidelines received from the central government, formulate the action plan for



# STRUCTURE OF CRISIS MANAGEMENT SETUP



J.B. = Joint Secretary

CAB. = CABINET

Fig. 5



dealing with the various types of natural calamities and coordinate the activities of all the departments involved in SCMG.

A control room will be set up in the State capital. It will receive and relay all information to the departments concerned with the relief operations.

#### **District level response:**

The Collector of the district will be the focal point at the district level for preparation of the district level plan and for directing, supervising and monitoring relief measures for natural disasters.

A contingency plan for the district for various types of disasters shall be drawn up by the district collector and got approved by the State government. The district collector will also coordinate and secure the input from local defense force unit in preparation of the contingency plan.

At district level there will be a relief committee to deal with the situation and a control room will also be set up for this purpose.

#### **Nicnet**

Now with the signing of memorandum of understanding with all the state governments and with their active support in implementing their computer communication network NICNET, every district of India has been linked with the State headquarters and with the center as well.

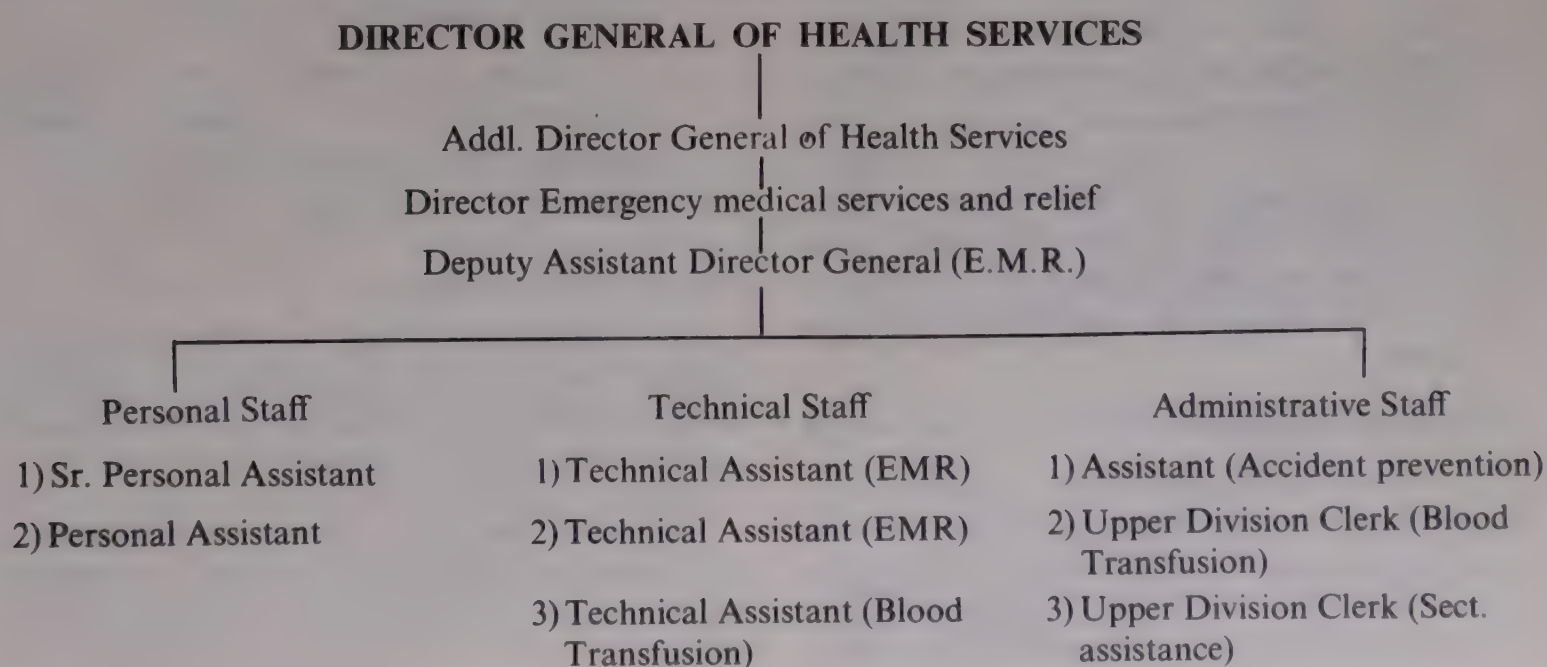
#### **Disaster preparedness at the health sector level:**

##### *Programme Co-ordination Activities at the Health Sector Level*

The Emergency Medical Relief Division of Directorate General of Health Services in the Ministry of Health & Family Welfare is the technical unit exclusively meant for management of crisis situations. This is headed by Director, Emergency Medical Services and Relief. For the purpose of the crisis situations, he reports/receives instructions directly from the technical chief (Director General of Health Services) and Administrative Head of the Ministry (Secretary Health & F.W.). The Secretary, Health & F.W. has empowered the Director, EMR to represent the Dept. for crisis situations in different Crisis Management Groups.

In the Ministry of Health & F.W. the mechanism of coordination is done through the office of the Director, Emergency Medical Services & Relief (EMR) with the Director of Health Services of the States, Stores Division under the Federal Government, Vaccine producing institutes and National Institute of Communicable Diseases and Director, Malaria Unit. This type of coordination is confined during disaster situations. In order to give a regular coordinating mechanism for any epidemic situations even during normal period a structure has been framed at various levels of health infrastructure (Centre, State and Districts), which would be put into operation shortly (Fig.6).

Fig.6 Staff structure





## Pre-Disaster Activities:

A detailed guideline separately for flood, drought, cyclone and earthquake has been prepared and is circulated in the month of March and April to all drought prone States and during May and June to flood and cyclone prone States. Telephone Nos. and other relevant information of the concerned officer at the State level are updated.

A control room at the State Directorate of Health Services and District Chiefs of Health is established. A permanent control room has been set up at the Union Ministry of Health to monitor any abnormal health situation in the country.

Officer incharge  
Telephone No. — 3012004  
Telex No. — 031-66119-DGHS-IN

## During Disaster:

### Arrangement for Feedback information:

During disaster Director EMR contacts the Control Room and the officer concerned at the State level either by telephone, telex or wireless system (Police Control Room) between 10 to 12 Noon. The feedback information consists of the following:

- a) The extent of disaster situation on the particular day;
- b) The extent of the population affected;
- c) Health profile, like the number of patients, type of patients and any problem in dealing with the situation.

The disease surveillance is done by the surveillance units of each State and co-ordinated at the Central level by the National Institute of Communicable Diseases.

### d) Medical Store supply position:

In case of requirement of additional medical stores, Director, EMR directs different medical stores located at Karnal, Delhi, Bombay, Madras, Hyderabad, Calcutta & Guwahati directly and instructs for

immediate air lifting of the medical stores.

### e) Vaccine supply:

Central Research Institute, Kasauli (H.P.) under Federal Government, Hafskine Institute, Bombay under Govt. of Maharashtra, King Institute, Guindy, Madras, under Govt. of Tamil Nadu, Institute of Preventive Medicine, Hyderabad under Govt. of Andhra Pradesh are kept in readiness to supply vaccines particularly for Typhoid and Cholera. Major responsibility however, is taken by the Central Research Institute, Kasauli.

As a matter of clarification, it may be mentioned that inoculation of cholera is done only on social pressure.

### f) Deployment of medical team:

By and large, initial re-deployment of medical team is done by District Chief from PHCs under him followed by medical teams from other Districts; by the State Chief of Health (Directors of Health Services) and by Director General of Health Services through Director, EMR at Federal level. Federal deployment of man power is done rarely as each State has adequate man power.

### g) Health Education:

Do's and Don'ts in local languages are regularly published by the D.H.S.. Central Health Education Bureau at the National level is engaged in this activity.

States of Tamil Nadu, Andhra Pradesh, Maharashtra, Gujarat, Punjab and Haryana are very active in this area even upto village level.

## Post-Disaster Activities:

Post disaster activities are mainly confined to repair of damage to health infrastructure, replenishment of medical stores upto pre disaster level and financial transactions.

Post disaster evaluation in a scientific manner and workshops/exchange of views of the lessons learnt are not done at present; both are very essential.



TABLE I

Extent of the damage of the monsoon rains in 1991

State/O.Ts	Period of Occurrence	Total Number of Districts	Number of Districts Affected	Population Affected (in Lakh)	Damage to Crops		Damage to Houses		Human Lives Lost (Number)
					Area (in Lakh Hectares)	Value (Rupees in Lakh)	Number	Value (Rupees in Lakh)	
Andhra Pradesh	29.07.91	23	1	2.86	0.05		750		
Assam									
(1st Wave)	05.05.91 to 21.05.91	23	7	19.07	0.13		8997		41
(2nd Wave)	12.06.91 to 3rd week of July		19	34.85	2.38		21571		38
(3rd Wave)	04.09.91 Continuing		2	1.37	0.15				1
Bihar	04.07.91 Continuing	50	7	1.66	0.05	12.29	3	0.03	
Karnataka	24.05.91 & Mid-June to 31 July 91	20			0.08		9400		106
Kerala	01.06.91 Continuing	14	14	72.67	5.78	10347.00	62398	864.10	125
Maharashtra	07.06.91 to 20.06.91, 28.07.91 to 31.07.91	32	12		0.01		10081		497
Meghalaya	July '91	5	1	1.00	0.03	221.00			
Madhya Pradesh	29.07.91 to 30.07.91	45	10		0.01		1566		20
Gujarat	July '91	19	NR						17
Assam	Mid July '91	13	8	23.10	2.50				18
2nd Week of August			7	55.29					
West Bengal	July '91	16	2	1.94	0.003	20.00	4345	38.00	14

### Training and research

There is no organized training and research facilities in disaster management. However, from time to time workshops have been organized at various levels with the assistance of WHO. This activity has generated lot of interest in most parts of the country, particularly in those states who are very active in their administrative management. The training activity would require expansion, more so in the north-eastern States and this workshop will set the pace for further development in this direction. The WHO has made a beginning in this direction and three collaborating centres are in the process of being opened.

In chronically drought affected areas nutritional survey and research may be necessary to assess the existing level of nutrition so that the affected people could be helped on a scientific basis. Based on this the Integrated Child Development Scheme under the Ministry of Welfare could be expanded in vulnerable areas.

### Role of Non-governmental Organisations (NGO):

Voluntary work perhaps is the only true measure of the inner strength of a society, for it embodies a certain degree of social commitment without which no society can sustain itself. While a comprehensive body of knowledge and skill can



exist in voluntary work accomplished in normal time, not much is available on that which is needed in critical times. This gap is proved to be immensely costly in terms of human sufferings and has often times sets at naught years of welfare efforts. In order therefore to reduce this gap and also to strengthen voluntary work it is desirable to undertake scientific studies of emergency welfare whenever possible.

The importance of a coordinated and effective

strategy for disaster relief and disaster mitigation is of prime importance.

The role of NGOs is no less important than that of the government efforts. The understanding between NGOs and government is vital in delivering benefits to the disaster victims. Here we do not set up a new mechanism but refine, develop and improve the existing cooperation. Every effort should be made to encourage NGO participation in disaster preparedness and mitigation efforts.

Table II

Frequency of tropical cyclones  
From 1891 to 1988

Months	Bay of Bengal		Arabian Sea	
	Cyclonic storm	Severe cyclonic storm	Cyclonic storm	Severe cyclonic storm
January	4	2	2	0
February	0	1	0	0
March	2	2	0	0
April	11	10	2	4
May	15	33	4	15
June	33	5	6	12
July	33	7	3	0
August	27	3	2	0
September	24	15	5	3
October	44	34	14	11
November	40	52	6	21
December	23	18	5	2
Total	256	182	49	68
	Total	438	Total	117



# DISASTER PREPAREDNESS (CYCLONE AND FLOOD) IN PONDICHERRY

*G. George*

## **Introduction:**

Nature has bestowed many bounties on the creations of the world and we are all blessed with them. But at the same time we have to face disasters created by the nature itself. These are natural events concentrated in time and space, posing serious threat to life and properties. They include cyclone, flood, earthquake, tornadoes etc. We are concerned here with disasters due to cyclone and flood.

Scientifically a cyclone is a wind storm often covering a wide area and lasting several days in which the winds blow spirally about a central area of relatively low barometric pressure. Violent weather is called a storm and its conspicuous feature is the high winds. A storm is also termed as "gale" when the speed of the wind is over 24 miles per hour, and it is "hurricane" when the speed is 75 miles per hour. Cyclones cause damages to ships, crops, trees and buildings. They also cause waves which sometimes flood areas and result in considerable material damage and loss of life.

Causes of flood are heavy rains on land already too water-soaked to absorb. Excessive rainfall in river catchment area also causes flood. Floods also damage crops, human and animal life and public utility services.

While natural disaster cannot be prevented, it is quite feasible to assess the vulnerability of different localities and develop early warning system to minimise the damage likely to be caused.

In our country usually the States of Andhra Pradesh, Orissa, Bihar and West Bengal face the threat of flood and cyclone with severe damages to life and property. Compared to these States the Union Territory of Pondicherry has not so far witnessed a tragedy of such a magnitude. However, in the past 15 years we have faced heavy rains/cyclone/flood in the years 1978, 1985, 1986 and 1990. In view of the elaborate preparatory and

precautionary measures adopted by this administration the situation has been always efficiently managed, thereby reducing the damages to the minimum. Before going into the details of disaster preparedness of this Union territory it is felt that it is essential to have a brief knowledge of the geographic, administrative, climatic and rainfall features of the Union territory of Pondicherry.

## **Geography:**

Pondicherry consists of four isolated units viz. Pondicherry, Karaikal, Mahe and Yanam. Pondicherry is the head quarters and is bounded by land on three sides by the South Arcot district of Tamilnadu while on the eastern side it is bounded by the Bay of Bengal. Karaikal is enclaved on north, south and west by the Tanjore district of Tamilnadu and on the east by the Bay of Bengal. Mahe enclaved by Cannanore district of Kerala is a tiny pocket bounded on the west by the Arabian sea, on the north by the river Moolakadaver and on the other two sides by a stretch of calcareous hills of medium height. Yanam enclaved by east Godavari district of Andhra Pradesh with a narrow stretch of land is limited on the south by the river Godavari and on the north and east by the branches of the same river, one of which is known as Coringa river.

## **Administrative set up:**

The administrative set up of Pondicherry Union Territory is different from that of other states and union territories. In view of smallness of the area the whole union territory is considered as one district consisting of four regions with 4 municipalities and 6 communes. There is one municipality and 6 communes in Pondicherry with 179 villages, Karaikal has one municipality and 5 communes with 110 villages and Mahe with one municipality and 3 villages and Yanam is a single Municipality which is entirely urban.



## Climate and Rainfall:

Pondicherry experiences hot and tropical maritime climate. As it is in the tropical maritime zone, summers are hot and winters not very cold. The diurnal range of temperature is low. Pondicherry and Karaikal experience hot and tropical maritime climate whereas Mahe and Yanam have humid and tropical climate due to high rainfall. Rainfall is variable from year to year and sometimes drought conditions also prevail as monsoonal winds often fail.

There are four seasons, viz., south-west monsoon period (June to September), north-east monsoon period (October to December), winter period (January and February) and hot weather period (March to May). For Pondicherry region the normal annual rainfall is around 120 cm of which nearly 63% is obtained during the north-east monsoon season. During the south-west monsoon it receives 27% of annual rainfall. For Karaikal the normal annual rainfall is 118 cm of which the north-east monsoonal rainfall accounts for 70% and the south-west monsoonal rainfall accounts for 21%. For Mahe the major part of rainfall is received during south-west monsoon period. Out of the annual rainfall of 319 cm which is the maximum in the Union Territory, the south-west monsoonal rainfall accounts for 246 cm i.e. 77% of the total annual rainfall. This is because of its location in the windward side of the Western ghats. The north-east monsoon rainfall is 40 cm. The Yanam region has overall rainfall of only 91 cm annually in which 49 cm of rainfall is during the south-west monsoon and 36 cm. of rainfall is during the north-east monsoon period.

Whenever a low pressure trough/depression is formed in the Bay of Bengal and a severe cyclonic storm is located it usually strikes the coast between Nagapattinam in Tanjore District and Nellore in Andhra Pradesh. Under its influence the sea-coast as well as the hinterlands of Pondicherry, Karaikal and Yanam regions experience incessant rains causing large scale inundation of widespread areas and extensive damage to crops, buildings, roads, culverts, etc. Besides the continuous, pouring rains bringing in copious flow of water in the river system of the regions, excess discharge of water from the dams in Tamilnadu also cause inundation and flooding, damaging not only the crops but also other properties.

## Nodal Agency:

The Collector-cum-Secretary (Revenue) is designated as the Nodal Officer under whose direct control and guidance various relief operations are undertaken by the departments concerned with the relief work in the event of occurrence of natural disasters of cyclone and flood. The Revenue Department which is the nodal department plays a vital role in coordinating the works of various other departments such as Public works, Electricity, Local Administration, Agriculture, Fisheries and Police etc.

## Status of Preparedness:

### i) Duty Chart:

Well before the onset of monsoon the departments concerned with the various rescue/relief operations during natural disasters prepare duty charts detailing the names of the officials who will be incharge of various types of works, the areas assigned to each of them, the officials in charge of control rooms, telephone numbers etc. The Revenue department compiles all the duty charts and brings out a booklet with the caption "Cyclone/flood Relief Manual" containing the scheme on relief of distress caused by the natural calamities, Do's and Don'ts for the benefit of the people, guidelines regarding seeking relief assistance from the Government of India, Vehicle allotment etc.

### ii) High Power Committee:

Advance measures are also taken before the onset of monsoon like convening the meeting of the High Power Committee comprising of the following members:

Chief Secretary	..	Chairman
Secretary (Revenue)	..	Member Secretary
Secretary (Finance)	..	Member
Secretary to L.G.	..	Member
Secretary (Local Admm)	..	Member
Secretary (Law & Labour)	..	Member
Secretary (Development)	..	Member
Inspector General of Police	..	Member



Sub Area Commander for  
Tamilnadu & Kerala  
Sub-Area Madras . . . Member  
General Staff Officer  
Grade-II, Tamilnadu  
and Kerala Sub-Area . . . Member

Besides the above members the Heads of departments/offices will also attend this meeting. Here are discussed detailed plans as well as itemwise tasks to be assigned to different departments to be in a state of preparedness to meet the real situations when they arise.

iii) *Meteorological Information:*

The India Meteorological Department (IMD) has already set up effective organisation for the detection and tracing of cyclonical storms. One of the centres is in Madras. Besides, cyclone warning radars are also located at Madras and Karaikal.

This facilitates the receipt of quick and prompt warning and the despatch of the forecast messages about the calamity. On receipt of such messages the Revenue Department immediately disseminates the information to all the departments connected with the rescue/relief operations to keep themselves ready to meet any emergency.

iv) *Warning:*

The Port department hoists storm warning signals in the main mast to alert the captain of the ship if any. The fishermen are alerted not to venture in the sea for fishing. All the people residing in coastal villages and low lying areas are cautioned and advised to shift to safer places. Wide publicity is made about the Do's and Don'ts to the public as in the annexure-II.

v) *Control Room:*

All activities of disaster management shall be conducted from the Control room from where commands shall be issued, all relief operations coordinated and into which all information shall flow. Hence

control rooms are opened in all important departments concerned with relief works and these function round the clock manned by efficient officers/staff.

vi) *Evacuation, Shelter & Food:*

People in the low lying area are evacuated and are sheltered in the nearby schools/kalyanamandabams and are provided with food.

vii) *Storing of equipments:*

Diesel engines are kept ready to be moved to low lying areas to bale out the stagnant water. Sufficient number of boats/catamarans are arranged at strategic points for immediate transport and relief operations like evacuation of the affected population to safer places.

viii) *Essential Commodities:*

Sufficient foodgrains and other essential commodities like kerosene oil, match boxes, candles etc. are stored by the Civil supplies Department so as to provide a succour to the affected population in time.

ix) *Medical Assistance:*

The Health Department is equipped with adequate drugs, vaccine and disinfectants in its dispensaries and Health centres to provide immediate first aid and other medical help to the sufferers and take all preventive measures to provide necessary sanitation in the areas such as disinfection of the drinking water sources and also to take preventive measures against the spread of any epidemic etc. Essential medicines for the live-stock are also stored.

x) *Allotment of vehicles:*

Sufficient number of vehicles are withdrawn from other departments and deployed to the departments involved in the relief work to carry out the relief operations without any loss of time. All repair works in the vehicles are attended to on priority basis and the latter are kept ready in good working condition to attend to relief works.



xi) *Assistance from Army:*

Depending upon the gravity of the calamity the services of the armed forces will be requisitioned in case of absolute necessity.

xii) *Relief assistance:*

Sufficient funds are made available in the budget for providing relief assistance in cash or in kind to rehabilitate the affected people by enabling them to repair/rebuild their damaged huts/houses, to clear their land for raising new crops, etc. Relief assistance is given on the scales prescribed by the Government of India according to which the maximum of Rs.1000/- is given as gratuitous relief and Rs.500/- as housing subsidy. Agricultural input subsidy to the small and marginal

farmers is granted at the rate of Rs.200/- per hectare. In case of severe damages warranting relief assistance over and above the scales mentioned above assistance from the Central Government is sought for by submitting a detailed proposal.

**Conclusion:**

Eventhough disasters are inevitable, death and destruction are not, provided one is well prepared to manage them. With the help of preparatory measures discussed from para 4 to 7 this administration was able to cope up with the cyclone/flood situations very efficiently reducing the damages to the minimum. It is felt that we should not only be prepared to face the calamity and their aftermath, but also plan ourselves so as to prevent extensive damages.



## ANNEXURE-II

### Do's and Don'ts For The Benefit of People Particularly Those in Coastal Areas

1. Keep a radio on, listen to the latest weather bulletins and avoid being disturbed by rumours; only official information should be passed on to the others.
2. Get away from low lying beaches without unnecessary delay and beware of streams and rivers which may flood with heavy rains.
3. Protect the house sufficiently by putting down the shutters, providing strong support to the outside doors, and pasting paper strips to glasses to prevent breakage.
4. Move valuable articles to the top floors for safety and tuck away tins, cans, tools and things which can become weapons of destructions. Get the house repaired during the period of 'lull' and remember that strong wind will return suddenly from the opposite direction with even greater force.
5. Get extra food, especially things which can be eaten without cooking, store enough drinking water and make a provision for children and adults requiring special diets. Keep lanterns and torches ready.
6. Supply of water for atleast 24 hours should be stored.
7. People should not take shelter near trees, dilapidated houses, old houses and insecure structures.
8. People should avoid stirring out when cyclone rages outside.
9. Boats and rafts should be tied at safe places.
10. The furniture, implements, steel barrels and other articles lying scattered on the roofs and in the open area cause damage by being thrown up during the cyclone. Such articles should be brought into the house and put at secure places.
11. Remove cattle to places of safety.
12. When evacuation becomes necessary, the following instructions should be borne in mind.  
Head for the shelter earmarked for the area without bothering about the property being left behind, follow the instructions of the personnel in-charge at these shelters and do not leave these centres till you are asked to.
13. The public should remain away from broken electric wires. In order to save a person struck with electric wires, one should use material such as dry stick to push the wire off. If a wire is found hanging the information may be immediately communicated to the concerned authorities.
14. The post-cyclone safety measures suggested are:—
  - i) Get inoculated against epidemics;
  - ii) Avoid damaged lamp posts and dangling wires;
  - iii) Keep away from disaster area unless you are asked to assist.
  - iv) Beware of anti-social elements who always cause mischief;
  - v) Drive vehicles carefully;
  - vi) Clear the debris in the house;
  - vii) Report losses of property to the authorities without exaggeration and
  - viii) Get the Health Department to disinfect wells and others sources of drinking water;
15. People should remain self-possessed in any circumstances. If one maintains patience and courage, others will be inspired thereby.



# RELIEF AND MANAGEMENT OF MASS CASUALTIES

*Lt. Col. S.S. Verma*

## Definition

A disaster is defined as an occurrence of a large number of casualties in a localised area, in a brief period of time exceeding the adjustment capacity of the affected community and calling for outside assistance.

There can be no talk of disaster unless as referring to an occurrence resulting in such an extraordinary measure of damage that the consequences cannot be dealt with by existing infrastructural, technical and emergency medical services. Additional assistance from outside is an essential requisite.

The crux of the problem, in managing a disaster, is that there is:—

Too much work  
For too few people who are  
Provided with inadequate facilities  
and Work under adverse conditions.

The management of casualties in war is the best planned, the most rehearsed and the best time tested method which can be applied to the management of mass casualties of any type of disaster. I proceed herewith to apprise you of the management of mass casualties at the time of disaster in a war.

This management of mass casualties does not start *after* the disaster has actually occurred. The emphasis is now shifted from post disaster improvisation to pre-disaster preparedness, when many more activities should be carried out to remain in a state of preparedness to meet any eventuality.

It will be easier to deal with the topic if we tackle the problem through the various *stages* of the disaster.

## *The Stages of disaster and Management of mass casualties at each LEVEL.*

Events during any disaster takes place in such a quick succession that it may be difficult to identify each stage of disaster separately. But broadly speaking the sequence of events can be divided into the following different stages:—

### *The Inter-Disaster Stage:—*

This includes the period between two disasters. As far as the management of disaster is concerned this is the most important and crucial stage.

It is not possible for our country to have a separate disaster management body, equipped with men and material ready to act on any call of disaster. The emphasis should therefore be more on improving the existing infrastructure and training the manpower in disaster preparedness.

### **Training of Manpower:**

The training should include:—

- a) *The Top level Managers:* Teaching of top level managers should include how to take decisions under crisis circumstances, and to be trained in disaster management planning.
- b) *The middle level Workers:* The middle level workers should be trained in implementing the disaster management policies and in how to coordinate among different sectors, so that they are clear as to what to do when the disaster strikes.
- c) *The grass root level Workers:* The first responders i.e. the local health workers, the leaders and the community at risk, who will be the first to respond, when the disaster strikes should be trained in basic life support and first aid.

The importance of training the community



in first aid has been realised of late. This itself goes a long way in reducing the morbidity and the mortality. It has been realised that among the community, the school children and their teachers are the most receptive groups to disaster preparedness, education and training. These children in turn should be stimulated to share this valuable education with their families and the community. Thus they are considered as multipliers of disaster information.

*The first Responders training:* The first responders should not only be trained in tying bandages and giving a few analgesics but also:—

- a) How to give emergency respiratory resuscitation.
- b) How to prevent loss of blood (compression tourniquet and their dangers).
- c) To counteract shock by positioning.
- d) How to place a person with respiratory difficulties in a safe position on his side (a semi-prone position with the head lower than the feet)—a life saving procedure that many doctors ignore, as experiences show.

#### *The Vulnerability Analysis of Disasters:*

Each state should collect the following information.

- The type of disasters the state is prone to.
- The disaster prone zones in the state.
- The population likely to be affected.
- The health facilities available in the area.
- The contingency planning with alternate plans of evacuation of casualties.
- The provision of immediate treatment.

#### *a) Identification of areas with their likely type of Disasters:*

In a State the areas prone to both natural and man made disasters should be identified. The different parts of the country are prey to different types of natural calamities.

For the natural disasters the country can be divided into five zones, they are:—

- i) *The Northern Mountain region*—Prone to Snow storms, Land slides and Earthquakes.

- ii) *The Indo-Gangetic plains* – Prone to floods and Droughts (Sometimes droughts alternating with floods).

- iii) *The Deccan Plateau*—prone to Droughts

- iv) *The Western Desert*—prone to Droughts

- v) *The Coastal area*—prone to Sea erosion, Cyclones and Tidal waves.

Similarly the likely man-made calamities can be identified in an area. Thus training in a particular State will depend on the types of disasters it is more prone to.

#### *b) The Risk Assessment:*

The risk assessment of the vulnerable area in a State can be gauged from the following data:—

The Demographic data

The Geographic data and

The Epidemiologic data.

The South-East Asia ranks fourth amongst the most disaster-prone regions in the world. The high density of population in this region results in the disaster effect being felt by the largest number of people.

#### *c) The Mapping of the Environmental Hazards:*

All the man-made and natural hazards in the disaster-prone area should be spotted on a map and the managers, the middle level workers as well as the community should be aware of it.

#### *d) The Contingency Planning:*

The contingency planning for managing any disaster should include.

- The Selection of Alternative plannings.
- Assessment of Logistic facility.
- Assessment of Communication facility.
- Assessment of Stores requirements.

#### *e) Medical Planning:—*

The medical planning should be carried out for:—

- Training of managers, middle level workers and the first responders.



- The establishment of casualty clearing stations and the requirement of spot treatment equipment and manpower.
- Speedy evacuation of the injured and the logistic and technical support required for the same.
- For local and regional hospital disaster planning.
- For epidemiological investigation data.

*f) Arrangement for baseline data analysis:—*

*g) Checking/rehearsing of the contingency planning at regular intervals, as part of the community and Govt. preparedness:—*

The training of the managers, the executives and the community, goes a long way in improving the preparedness state of a community at risk and thus renders them more confident in combating any disaster.

### **The Pre-Impact Stage:—**

This is the period immediately before a disaster strikes in which some warning about the impending disaster is given to the local community to prepare themselves for the disaster; the cyclone or pre-flood warnings are typical examples. This state is actually meant to keep the people in the vulnerable areas in a state of alertness and to initiate measures to minimise effects of impending disasters like evacuation.

In 1975 Chinese made accurate short term predictions of Earthquake and hence no loss of life followed the Manchurian tremor of 7.3 magnitude on the Richter scale. But the very next summer without warning, the Tangshen earthquake left a quarter million dead and practically wiped out a major industrial city.

Thus prompt action taken at this stage goes a long way in reducing the casualties.

### **The Stage of Disaster:**

This is the period in which the disaster strikes the community located in a particular area. This stage of disaster could be further classified into:—

*i) Stage of Isolation:—*

This is the period immediately after

a disaster has struck, during which maximum morbidity and mortality occurs. There is destruction of property and communication. Help is not available even from one individual to another. There is complete isolation of each and every member of the community. No relief of any sort can be provided at this state.

*ii) Stage of Rescue:—*

This is the phase of recovery from unexpected miseries where the affected communities try to group and start rescuing each other. There is still complete isolation. However, the community itself organises rescue team and start evacuation of the affected population. If the community is trained in basic life support and first aid, it goes a long way in reducing the morbidity and mortality of the casualties. It is here that the training of responders is realised.

*iii) Stage of Relief:—*

The stage of relief starts with the arrival of the first rescue team from the unaffected areas. Usually it takes 24–48 hours to provide such a relief.

The essential services are provided on a temporary basis. Temporary communication is established, water supply is handled by tank trucks, emphasis is placed on environmental measures, and sanitation and provision of emergency shelters, are undertaken.

### **Assessment of the Requirement of Health Care:—**

It is unavoidable that immediately after a disaster there will be little reliable specific information on the extent of damage and of medical need. To plan an effective relief operation it is essential to have information that is accurate or atleast of a known degree of accuracy. The following informations are urgently needed by the managers of the disasters.

- a) Confirmation of the disaster.
- b) Extent of the area damaged, to be confirmed.



- c) The total population affected.
- d) The functional damage to public services, transport and utilities.
- e) The number of health centres, dispensaries, hospitals functioning and their location.
- f) Whether the capacity of the operable hospital has been impaired.
- g) The number of medical and para-medical staff available for work.
- h) The availability of medical equipment and stores.
- j) The number and rates of injuries i.e. sites of injuries or its severity (eg. fracture of legs and arms).
- j) The possible risk of outbreak of communicable disease (Even though the possibility of actual outbreak may be low, yet a rapid survey of the disaster area will provide a baseline data for an epidemiological surveillance system in which suspected cases of selected diseases are reported).
- k) The condition of the water supply and sanitation systems, as these will have a direct effect on the health of the survivors of the disaster.

#### **The Convergence Reaction:—**

The most difficult problem during this phase is the so called "convergence reaction". Relatives, friends, volunteers and other people (international relief agencies) converge on the affected areas. This reaction consists of often useless and unsolicited people, supplies and information and is the main cause of the confusion and chaos which have the most adverse effects on the stricken population and often neutralize sound emergency medical care measures.

#### **Organisation of Medical Services for Management of Mass Casualties:—**

The mechanics of the disaster situation must first be considered. The emergency services must orientate themselves on 3 "Ts" of military medicine, *Triage*, *Treatment* and *Transport*.

- 1. The injured must be first removed rapidly from the site of disaster.
- 2. They should then be assessed for the urgency of intensive first aid (*Triage*) and the initial *Treatment* started at once.

- 3. The injured must then be transported to a temporary or permanent local hospital.
- 4. At the hospital they are again reviewed and treated (*Treatment*).
- 5. They may be further transferred to a regional or provincial hospital,
- 6. and Finally to *Rehabilitation*.

#### **The Removal of the Injured:—**

Adequate and trained personnel should be recruited for extrication of the casualties from the site of danger to safer places or to the medical aid post. The medical team should not get involved in the extrication of casualties, but can give advice.

#### **The assessment for Intensive First Aid:—**

The assessment of the injured for providing initial first aid and evacuation is usually done at the casualty Clearing Station.

#### **Establishment of Casualty Clearing Station:—**

The Casualty Clearing Station is established at the site of the disaster or in a nearby local health centre in a suitable building or other protected structure and in natural disaster even under a tree close to the road. All the equipment of the centre has to be transported to it and water and food supplies arranged for the injured and the staff.

The decision to establish the station near or at the site of disaster is taken by the medical unit. In disasters the nearest local or receiving hospital should send out a small but efficient staff to establish the Casualty Clearing Station. The dispatch of such a team and its equipment to the disaster scene must be planned, before-hand. This is part of the hospital disaster plan and cannot depend on improvisation or adhoc arrangements.

Good planning will also reduce the lapse of time between the occurrence of a disaster and arrival of clearing station staff at the scene of the disaster.

The emergency medical equipment should be simple and packed in well marked containers suitable for transfer over rough ground.

The staff of the clearing station must be led by



an experienced physician whose duty is to establish the station, assess casualties at the first triage, and start the immediate basic life support treatment necessary for safe evacuation of the injured.

It is the quality of care which counts rather than the qualifications of the crew. The status of those giving the care is relatively unimportant.

#### **The Triage:—**

The "Triage" is a French word and primarily a military term that means to sort or to separate, whenever time, personnel, and resources are grossly insufficient to meet all needs in a disaster situation. With the occurrence of a large number of casualties, sorting or triage is the only approach to provide a maximum benefit to most of the injured.

The triage consists of classifying the injured rapidly on the basis of the benefit they can expect from medical care and not according to the severity of the injuries. Higher priority given whenever basic life support is needed may modify dramatically the immediate or long term prognosis. Moribund patients, who require much attention for a questionable benefit have the lowest priority. Triage is often neglected in the climate of emotion and confusion. By Triage the patients are divided into three categories. They are:—

#### *First Category:*

They form about 20% of all casualties and consists of those who require urgent life saving treatment. They should be prepared by skilled emergency resuscitation and evacuated as soon as possible in the reception area of the local hospital. These patients are immediately reassessed so that those requiring urgent operation are resuscitated and transferred to the operating area as soon as possible.

#### *Category I:*

This category includes casualties suffering from severe bleeding from easily accessible sources, obstruction of the respiratory tract, pneumothorax or haemothorax (in which case it must be established that the obstruction can be removed in the shortest possible time), hypovolaemic shock, severe injuries to the extremities, facial burns or burns to the upper respiratory tract.

#### *Category I B:*

The second group of this category is those casualties in whom slightly delayed treatment can be considered. They form 20% of all casualties. Having received possible life saving treatment, their lives are no longer in acute danger, so that an operation can be performed within the next 6 to 8 hours, although the timing of the injury must be taken into account. This category includes casualties suffering from fractures and dislocations, injuries to the abdomen and the thorax and also the urogenital tract, the skull or the brain and second degree burns covering 20–50% of the body or third degree burns covering upto 30% of the body.

#### **The Second Category:—**

They form 40% of all casualties and consist of those, whose injuries are minor and do not require urgent life saving treatment and can wait for evacuation or make their own way to a clearing station or to a hospital. Many of them can be treated on an out-patient basis.

#### **The Third Category:—**

They comprise 20% of all casualties and consists of those who are moribund i.e. dying or the injured with no chance of survival and beyond the scope of medical care likely to be available in a disaster situation. It is useless to evacuate and/or treat a victim with multiple and severe injuries and in shock, who might only be saved by the most sophisticated intensive care, when only simple facilities are available.

These patients must, however, be reviewed every hour at the scene of the disaster or after arrival in the hospital, since some of the injured whose condition seemed desperate may, on second assessment, be saved when evacuated with the first category or after second review in the hospital, operated right away.

Similarly the second category should be reassessed as some of them may be more seriously wounded than they seemed when examined initially.

#### *Labelling of the Casualties:*

The important part of triage is to attach



discs and labels to the patients. Red disc for priority I, Green disc for priority II and Yellow disc for Priority III. For easy identification of the casualties at the receiving local regional hospital, the tags should be attached to the patients. They should indicate the category, the initial and the follow up diagnosis, the drugs given, and the exact time of application of the tourniquet (as the last resort for haemostasis). This principle of "tag first and then treat" is an absolute prerequisite for effective mass casualty management. For this, the colour coded tags may be used. The supply of standard tags should be a part of regional and hospital planning.

The second category or group must not, however, block transport and interfere with immediate evacuation of the first group. Nor should they occupy beds at the receiving local hospitals until all those in the first group have been hospitalized.

The majority of the trained medical personnel should stay at the receiving local hospital where they are more effective and they must not be permitted to rush to the site of the disaster, thus contributing to the harmful convergence reaction.

#### *The receiving or local Hospital:—*

The nearest local hospital having facilities of surgery and basic resuscitation equipment should be considered as the local receiving hospital. There might be more than one such hospitals in the locality. All of them should be considered for the management of the casualties.

The hospital should receive advance warning for the influx of the casualties, so that they plan the reception, the treatment and the evacuation, accordingly.

In the reception the most experienced surgeon should be put on duty. An additional triage, on receiving the casualties should be carried out by him and those requiring immediate surgery should be resuscitated and transferred to the operating room, directly. In a small hospital, with only one surgeon, the senior physician must be entrusted with this vital function. In larger hospitals an experienced anaesthetist may take up this duty.

In the reception room, emergency equipment for intravenous infusion and maintenance of

respiration would be stored and those supposed to use it must be clearly designated.

The second and third category patients are reassessed periodically as stressed for the clearing station.

#### **The Hospital Disaster Plan:—**

Every hospital should have a well planned and rehearsed disaster plan, so that the entire staff is conversant with it. A special Command structure should be adopted in case of a disaster. The command team should comprise of senior officers in the medical, nursing and administrative fields, and the senior anaesthetist. The team will direct the people where to work according to the plan, and mobilise additional staff and additional resources as required. The written plan should be well displayed in wards and casualty areas:

#### **The Plan must:—**

1. Designate the reception area and the staff to man it.
2. Indicate equipment that must be moved into it.
3. Designate the wards to be cleared to admit casualties and indicate where the patients from these wards should go.
4. List the staff (and their substitutes) who should go to the disaster scene to establish the clearing station. If a clearing station does not need to be established the staff who would have been there should go to reception area.
5. Indicate where the equipment for the clearing station is kept and list the items.
6. Indicate where each member of the staff of the hospital should go and their precise functions with substitutes named for key personnel.

#### **The regional or provincial hospital:—**

These hospitals accept the injured from the receiving or local hospitals who require specialised treatment, Regional hospitals have all the resuscitation and other specialised services such as orthopaedics, neurosurgery, cardiovascular surgery, treatment of burns and haemodialysis etc. These hospitals must have an adequate plan to cope



with the situation as outlined above. Evacuation from local hospital to regional hospital is to be carried out rarely in a hurry but trained personnel should usually accompany the injured to maintain intravenous transfusion patent air ways etc.

#### **Management:—**

When a disaster strikes, multiple and inter-dependent difficulties occur such as :—

- a) Breakdown of communications (often insufficient even under normal condition in developing countries).
- b) Delay in realising the extent of disaster. For example, when there was a cyclone in East Pakistan, in 1970 and an earthquake in Peru in 1970, more than a week elapsed before the extent of the disaster was realised. This led to a delay in arrival of the emergency supplies.
- c) Due to lack of communication, the health service or national relief organisations like the Red Cross, are overwhelmed by unnecessary supplies, specially, unsorted medicines.
- d) Weeks might elapse before relief supplies, rather urgently needed and stores can be transported to the outlying districts of the

disaster areas due to shortage of transport facilities. Majority of stores items may pile up in warehouses at airports and harbours.

- e) Lack of coordination and organisation in the total relief work. An example is the different relief organisations or agencies working more or less independently of one another in disaster area, creating harmful duplication or launching of worthless vaccination campaigns.
- f) Many relief groups are really not prepared for relief operations and often in-experienced and ill adopted relief teams from developed countries become a hindrance to an effective assistance in tropical or developing countries.

#### **Stage of Rehabilitation :—**

The activity of the management of disaster does not end the moment the TV cameras focussed on the site of disaster pack up and the press reports fade. Actually the main work starts then. All the victims of the disaster have to be rehabilitated. The patients, after discharge from the hospital, if disabled, should be given occupational therapy to make them stand on their own feet and hence become useful members of the society. Many have to be given prosthesis.



# HEALTH ASPECTS OF DISASTER MANAGEMENT

*Dr. S.P. Mukhopadhyay*

## **Introduction:—**

The eastern region of India is very much prone to natural disasters like flood, cyclone, landslides and earthquakes. Amongst all these, flood is the most common.

Every year flood hits invariably some district or the other although there is variation in intensity, magnitude and management as regards the action plans and the measures taken. There are of course, strategic approaches common to all the districts though there might be marginal variations as regards the magnitude of the health problems and their management. Among all the eastern states, West Bengal was adopted as the pioneering fact-finding state for disaster preparedness programme in particular in relation to health aspects. Naturally, this paper is limited to the health problems due to calamities like flood.

Before these health aspects are considered, it is better to have an idea about all the types of natural disasters that take place in this state. They are:

- 1) *Flood*: This is regular during monsoon. There are 16 flood prone districts with a total of 90 blocks and about 10 million people are affected.
- 2) *Drought*: Apart from floods, drought situations are seen, mainly in four districts.
- 3) *Cyclone*: Cyclone occurs in the coastal belt of South 24 parganas, Midnapur and also North 24 Parganas.
- 4) *Landslides*: The hilly areas of Darjeeling has landslides.
- 5) *Earthquake*: Earthquakes are restricted to the hilly areas.

## **Magnitude of the problem due to natural disaster:—**

The chief factors for the various health problems here are due to:—

i) *Direct Impact*: Drowning, heat stroke, accidents due to house collapse etc.

ii) *Damage of existing infrastructures*:

- a) Loss of water supply, power supply and sanitary facilities including houses leading to polluted water, insanitation and exposure to adverse climate.
- b) Scarcity of water and food.
- c) Ineffective functioning of the available facilities including health institutions.

iii) *Combination of the above factors*:—

- a) Floating population transmitting diseases to the local population.
- b) Population aggregation at relief centres etc. creating conditions for disease outbreaks.
- c) Population density favouring transmission of diseases.
- d) Over-load of work in the existing health facility leading to inadequate and inefficient services.
- e) Psychological manifestations—due to loss of lives of relatives/properties.

iv) *Common ailments/diseases found during/after flood*:—

- a) Respiratory diseases;—common cold, cough, pharyngitis, bronchitis, pneumonia.
- b) Water-borne diseases—diarrhoea, gastro-enteritis, dysentery, viral hepatitis, poliomyelitis.
- c) Skin disease and eye infections—due to lack of personal hygiene and over crowding.
- d) Injuries (not very common).
- e) Insect borne diseases—malaria, filaria etc.
- e) Snake bite/insect bite.



v) *Common ailments/diseases found during droughts:—*

- a) Water borne diseases; dysentery, diarrhoea, gastro-enteritis, typhoid, viral hepatitis.
- b) Malnutrition and its complications.
- c) Dehydration and heat stroke.

d) Respiratory infections: pneumonia and bronchitis.

e) Infectious diseases: measles, chicken pox, whooping cough and meningitis.

f) Skin diseases: dermatitis and scabies.

g) Conjunctivitis.

h) Parasitic diseases: malaria and ascariasis.

Annual occurrence of some major diseases for three years are given below:—

Type of Diseases	1986	1987	1988
Water borne diseases	7,159	15,329	4,695
Respiratory diseases	1,57,220	98,235	10,186
Nutritional diseases	1,32,356	76,364	15,246
Other health problems	26,63,797	11,39,062	4,77,686
Total deaths	214	115	45

✓ **Medical Care and Public Health Planning in Disaster Management:—**

Relief management during any disaster does vary according to the character of the disaster. In case of slow processes tending to last for a longer duration, real hazards to health do emerge. The inappropriateness of timing and the nature of relief assistance is in no small part, due to a lack of sound method for assessing these varying needs. Thus while preparing a blue print of a disaster management, all the relevant issues must be given due consideration; in fact some informations are needed essentially in advance at all levels. All this would greatly help in reducing the response time (and thus minimising the damage) and in improving the state of preparedness. Preparation of an action plan needs the following prerequisites:

- 1) Identification of all the possible disasters that may strike the area.
- 2) Analysis of the possible damages that may be caused at varying degrees of intensity of the disaster.
- 3) Identification of the feasible steps—long-term and short term—for prevention/mitigation of the possible hazards.
- 4) Assessment of resources available locally i.e. manpower, materials, existing infrastructure including communication and transport.

- 5) Identification of the sites for shelter outside the affected zone.

The preparation of the action plan envisages the following components:—

- 1) Arrangements for monitoring and dissemination of information.
- 2) Clearly enunciated methods for assessment and for taking decisions in regard to the gravity, the intensity and the level of the disaster, as well as the scale and the degree of response to be mounted.
- 3) Quick mobilization and development of essential manpower, equipment, transport and stores, as well as the release of funds necessary for containment and relief.
- 4) Prompt activation of the existing infrastructural facilities.
- 5) Comprehensive listing of the identified emergency personnel and a clear charter of duties for all of them.
- 6) Arrangement for informing the people of the situation and of their Do's and Dont's and for briefing the press for circulation of information to other posts so as to allay undue apprehension and prevent the spread of rumours which may cause panic.
- 7) Maintenance of co-ordination at different levels.



## ✓ Details of the action plan in the management of flood-emergency:—

### d) Preparatory measures:—

The preparatory measures are undertaken by each district health authority from first June every year. This consists of:—

- 1) Identification of the usual flood prone areas. Holding of the district level co-ordination meeting following the state level coordination meeting of the concerned departments. Holding of the meeting of district level, sub-divisional and block level officers of the Health department including all the Chief Medical Officers of Health (CMOH) for discussing the strategies to be adopted.
- 3) Assessment of the requirement of medicines and equipment for advance procurement and storage in vulnerable area. (The scale of requirement that has been worked out and the identified items are shown in Table-I). On receipt of these stores, the district health authorities are to shift the required portions to the actual points prone to be cut off from the district headquarters (Table II).
- 4) Institution of preventive measures like disinfection of drinking water source and health education relevant to floods.
- 5) Assessment of the requirement of additional manpower. The requirement of additional health manpower per every one lakh of affected population should be identified. Additional manpower may be obtained from the unaffected areas of health institutions of the districts, or if necessary, from other unaffected districts/medical colleges. Principals and Superintendents of the medical colleges and CMOHs may, therefore, prepare advance lists of medical officers of their own institutions in the scales of ten medical officers from each medical college, four medical officers from each district hospitals, and two medical officers from each sub-divisional/state hospitals. Personnel attached to the mobile medical units at state headquarters, if any, should be treated as public health emergency squad and be utilised accordingly.
- 6) *Transport*: Repairable departmental vehicles in the districts as well as state headquarters should be set right in advance so

that they may be pressed into operation on a short notice.

- 7) *Control Room*: As soon as a report of the occurrence of flood in any part of the State is received, a flood control room may be set up at the districts with adequate staff and vehicles for receipt of reports from the affected areas and for the dissemination of instructions from the state headquarters to the concerned area/district.
- 8) The State headquarters control room may function from morning to evening in two shifts or round the clock in three shifts depending upon the nature of the emergency. This may be provided with one temporary direct telephone line for the entire flood season (i.e. from 16th June to 15th October). Similar flood control room may be set up at the district headquarters by the CMOH as soon as a report of the occurrence of flood from any part of the district is received.
- 9) Involvement of the voluntary organisations. The CMOHs should enlist in advance the names of the reliable voluntary organisations located in the districts, particularly in the flood-prone areas for assistance in tackling public health emergencies.

### Health relief operations amongst the flood victims:—

- i) To ascertain the following correctly from the district magistrate/sub-divisional officer:—
  - a) Extent of damage done in respect of health institutions such as Hospitals/Health Centres/Sub-centres etc.
  - b) Areas affected.
  - c) Population affected.
  - d) Communication channel affected.
- ii) To arrange to meet together with all the health and public health engineering officers available at the headquarters as quickly as possible.
- iii) To prepare a sketch map of the affected area and estimate the resources available within that area such as: manpower of different categories of health and public health engineering department; dis-infectants, vaccines and medicines; spare parts of tubewells and the vehicles.



- iv) To prepare an approximate estimate and requirement of additional resources on the above categories.
- v) To send one officer from the District and Sub-divisional headquarters for supervising about 1 lakh population with: additional man-power including public health engineering (in consultation with the Assistant Engineer); disinfectants, vaccines, medicines and equipments; and the vehicles deployed from other non-affected areas.
- vi) To make a suitable Head Quarter at the nearest PHC/SHC/Sub-centre/School or any other suitable building where these materials can be temporarily stored.
- vii) To form teams for relief work with a Doctor, Sanitary Inspector/Health Supervisor, Health workers and one or two Group-D workers and a mechanic of Public Health Engineering, if possible.
- viii) To allot areas of health relief operations for each such team.
- ix) Country Boat/Bullock cart/Mazdoor may be hired at local rates for each team to carry medicines, disinfectants etc. to the respective places of operations. These teams may preferably be spread out in the affected villagers in batches of 2/3 according to convenience.
- x) When the tubewells and the wells are sub-merged under water and the drinking water supply sources are all polluted, halazone tablets should be distributed to the families with necessary health education.
- xi) As soon as flood water has receded, mass disinfection of wells and tube-wells should be undertaken; in this respect the help of local public health engineering section may be taken.
- xii) Common medicines for treating gastrointestinal disorders, respiratory infections, malaria and rendering first aid should be present with every team. All health centres should possess a stock of anti-venum serum to treat snake bite.
- xiii) The team should meet in the evening to present their reports and returns at the temporary headquarters. These are to be collected by the Sanitary Inspector of the block and despatched after compilation daily to the local headquarters in the prescribed forms (Table-III).
- xiv) Any sickness or absence of a worker of the relief team should immediately be reported to the officials concerned so as to replace him quickly. District and local administration should restrict sanction of leave and curtail long leave for those who are enjoying such without illness.
- xv) Expenditure report on special sanction for flood on permissible items such as hiring of boats etc., purchase of kerosene oil and additional stationaries and P.O.L. for vehicle etc., should be compiled and sent as quickly as possible. Additional allotment if any required, will be considered on the basis of such reports received in time.
- xvi) A leader of the local health team working in different parts should maintain a close liaison with the teams of relief department so as to co-ordinate the activities.
- xvii) A control room at the headquarters of the CMOH should be set up to co-ordinate the activities with the control room of the District Magistrate as well as that of the State headquarters under the Health department.

#### Discussion:—

It is accepted that the development of science has not reached a level when nature can be controlled. As such, rainfall will occur, landslide will take place and earthquake will happen. Fortunately the meteorological science has a tremendous innovative approach in predicting quite appropriately the signal of danger<sup>1</sup>. This is therefore the key factor for disaster management. Receiving the danger signal in advance and disseminating the information to the community level as early as possible is considered to be a very important process in the effectiveness of the preparedness programme as far as health is considered.<sup>2</sup> It is to be emphasised here that if this preparedness programme to mitigate the effects on health during disaster is strengthened, there will be minimum damage as regards life and health. The thrust areas to be considered carefully are the ways and means for rapid assessment<sup>3</sup> of the health problems that are precipitated by the calamity and the timing of the application of measures appropriate to the



situation. It is also to be stressed here that any preparedness programme i.e. plan in advance before the disaster strikes must be tested for its operational effectiveness at the time of a crisis situation<sup>4</sup> from time to time (mock exercise). Trained manpower is considered a valuable resource so much needed to identify health problems as well as to undertake meaningful actions. Training in health care during

all adverse situations is one of the important components of the training needs. In-depth knowledge of disaster epidemiology and the development of technological as well as management skills should be included as integral curriculum in training programmes. This is obligatory to strengthen the preparedness programme for effective disaster management of health aspects.

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TABLE I

**LIST OF MEDICINES WITH QUANTITIES MENTIONED AGAINST EACH REQUIRED FOR  
20 BLOCKS/20 LAKHS POPULATION**

Sl. No.	Name of Medicines	Quantity
1.	Bleaching Powder	50 kg. × 100 drums (1kg. of B.P. should be mixed with 9 kg. of lime for use for sanitation purpose).
2.	Halazone Tab.	15 Lakhs
3.	O.R.S.	15000 Pks.
4.	Phenyle	50 Tins × 4 Litres
5.	Dettol	20 Tins × 5 Litres } Any antiseptic lotion
6.	Furazelidine Tab.	5 lakhs & Suspension Furoxone
7.	Metronidazole Tab.	10 Lakhs
8.	Cntrimaxazole	10 Lakhs
9.	Tab. Paracetamol	20 Lakhs
10.	Tab. Antispasmodic	1 Lakh
11.	A.V.S.	100 Vials
12.	I.V. Normal Saline/Inj. Dextrose Soln.	1000 Bottles
13.	Tet Vac.	10000 Doses
14.	Rect. Spirit (500 ML)	1000 Bottles (Mythylated Spirit)
15.	A.C. Vaccine .	2500 Doses
16.	Benzyl Benzoite Lotion (500 ml)	1000 Bottles
17.	Anthelmentic Syrup	100 Phials
18.	Lotion Gential Violet (500 ml)	1000 Bottles
19.	Lotio	1000 Phials
20.	Antidiarrhoeal Suspension	2000 Bottles
21.	Eye Drops	1000 Vials
22.	Gauze	200 Thans
23.	Bandage	200 Thans
24.	Absorbent Cotton	500 Pkts.
25.	Glass Syringe	1000 Pcs.
26.	Disposable Syringe	1000 Pcs.
27.	Disposable Needles	1000 Pcs.
28.	Needles	1000 Pcs.
29.	Transfusion Set	1000 Sets
30.	Adhesive Plaster	100 Roll



TABLE II

**LIST OF DISTRICT-WISE POINTS OF STORAGE OF MEDICINES ETC. FOR CATERING TO  
THE NEEDS OF THE CUT OFF AREAS**

Sl. No.	Districts	Sub-stock to be maintained at	For catering to the needs of the blocks
1.	Nadia	i) Karimpur	Karimpur-I, II & Tehatta-I,
2.	Murshidabad	ii) Kaligunj Kandi	Kaligunj Kandi, Khargram, Bharatpur-I, II, Burdwan
3.	Cooch-Bihar	Mekhlignj	Mathabhanga, Mekhlignj Block
4.	Malda	Manickchalk	Manickchalk Block-I & II
5.	West Dinajpur	i) Balurghat ii) Ranignj iii) Islampur iv) Itahar	Sadar Sub-Divn. Ranignj Sub-Divn. Islampur Sub-Divn. Itahar Block
6.	Hooghly	Khanakul	Khanakul-I & II
7.	Midnapur	i) Moyna ii) Contai  iii) Daspur iv) Sebong	Moyna & Tamluk-I Rampur-I & II, Rgra-I, II Contai-I & II Blocks Daspur-I & II Sebong & Pingla Block



Revised Proforma for Administrative Instruction No.8 of 1958

District . . . . .  
 Sub-division . . . . .  
 Block . . . . .

Block/ Municipality	Total Population (Estimated mid- year)	G.P. with Mouza/ Municipality ward affected	Population affected	Relief Camp set-up		Out-break of Gastroenteritis				No. of patients treated	Inoculation done		
				Number	Population	For the day	Since commencement	Attack	Death		Attack	Death	For the day
1	2	3	4	5	6	7	8						

[illegible]



# DISASTER RELIEF THROUGH VOLUNTARY AGENCIES

Dr. Shirdi Prasad Tekur

Disaster is defined by the Oxford English Dictionary as 'a sudden, great misfortune'. For practical purposes, it has to be understood that disaster is not the event itself.

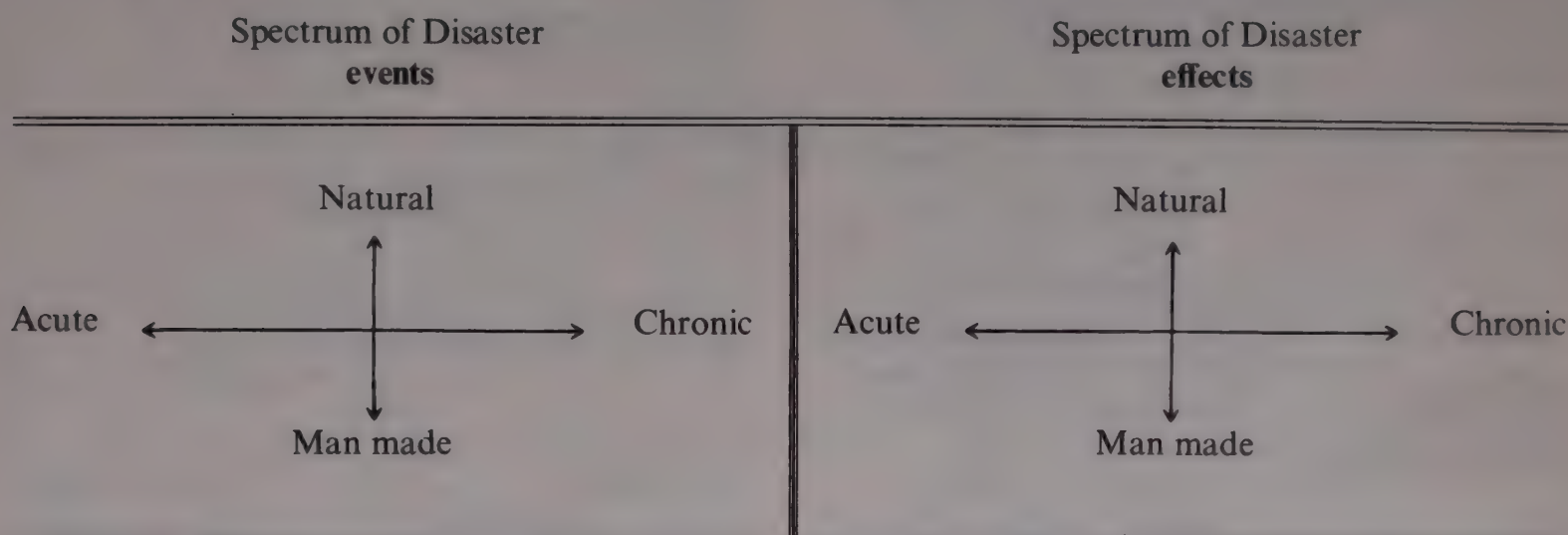
Disaster is the situation arising out of an event where disruption of a great magnitude occurs in life (human, animal and plant) and life supporting systems (water, air, sunlight, food, etc). This separates a disaster from an accident or incident.

Disasters could be simplistically classified as 'natural' or 'man-made' with effects ranging from

'acute' to 'chronic' states of disruption. This is misleading.

A complex relationship is now being increasingly appreciated between natural and man-made disasters, while most acute states lead on to a long term or chronic phase.

Hence, a spectrum of disaster events is suggested as in the diagram below, ranging from the natural to man-made in origin and acute to chronic on a time-scale. This is true of the disaster effects also.



What should be of great concern to us is the disruption (of a great magnitude) in various systems needed for survival in the individual, family and the community level during a disaster.

## Response to Disaster:—

The response to disasters usually occurs in three phases:

- 1) *Rescue and Relief*: This is directed towards Rescue, Food, Water, Shelter, Clothing, Emergency Medical Aid, Communication and Census Operations.

This phase lasts between one to three months, involves predominantly external agencies and is a welfare effort.

- 2) *Short Term Rehabilitation*: Here, health work continues with medical aid and is also directed to environmental sanitation and safe drinking water.

Economic measures with food and money for work, while the local industry is helped to get re-established.

Social measures towards the family, tracing



missing persons and a start in community reorganisation.

Building activities for shelter, protective bunds, schools and religious institutions.

This phase starts with phase one, and lasts for one to two years. It entails *community involvement* where the external agency shares the work and responsibilities.

3) *Long-term Rehabilitation*: This is mainly a development activity, with community organisation for development in social economic, health and other related areas. Also, preparations to face any other disaster are made here.

This is predominantly a community activity, requiring *community participation* and extends beyond two years.

Planning should ideally aim at self sufficiency of the community (i.e. community participation) in tackling disasters from phase one itself.

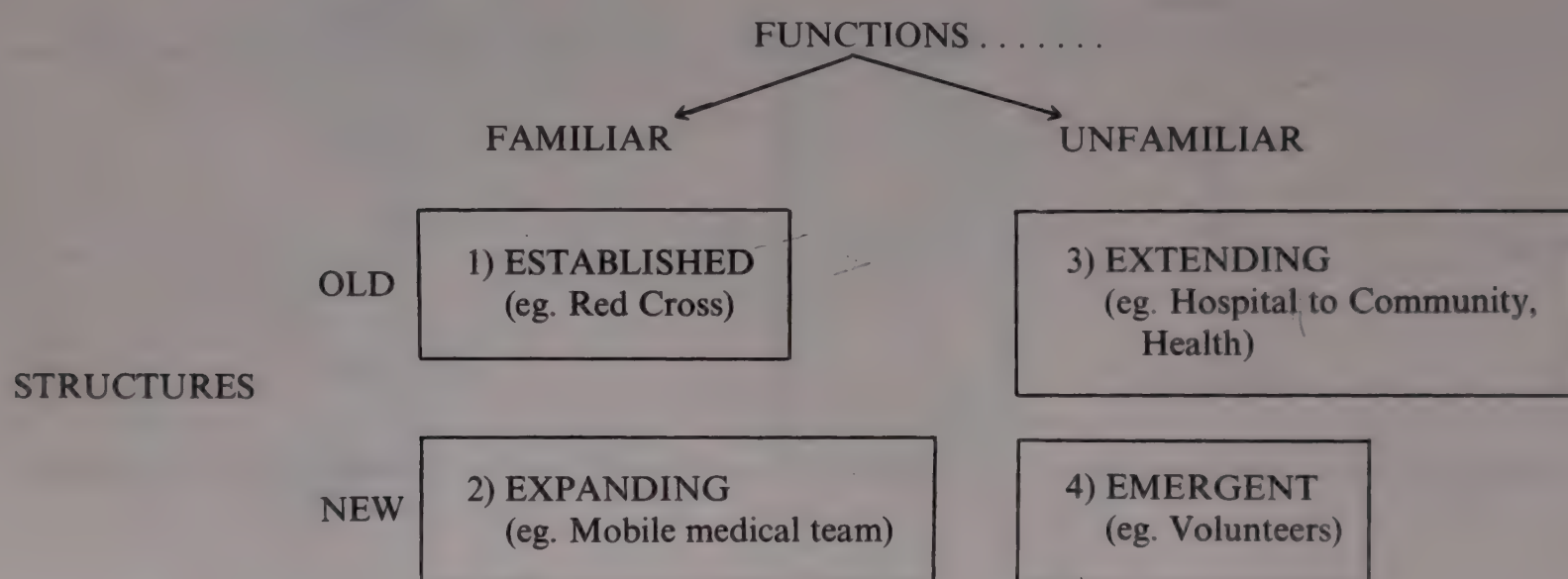
Key concepts which emerge when we consider these three phases are:

- a) the relationship of disasters and their management to development processes, and
- b) the relationship of these three phases to each other and how one phase should set the stage for the next.

A similar relationship is true to the pre-disaster, the disaster and the post-disaster phases of human life.

#### Agencies involved in Disaster Mitigation:—

The diagram below explains the types of agencies, depending on their structure and function.



- The training needs of each of these groups differ; the *established* need updating to newer needs and techniques,
- the expanding need orienting to a changing scenario,
- the extending need adaptation to change in role, while
- the emergent need to know the basics of all aspects of health-disaster management.

#### Voluntary Agency Response Experience:—

A brief review of Volag response to the recent

Bangladesh Cyclone Disaster 1991 is attempted below, in two phases (a) Bangalore and (b) Bangladesh.

a) *Bangalore*: As news reports came in on TV, AIR, newspapers etc., some of us who felt concerned started discussing the tragedy and met a few times to see if we could help.

A team of eight out of the nineteen volunteers was formed. The team consisted of three doctors, two nurses and three paramedics (those involved in community



health in some way or the other, with no trained 'medical' skills.

The team prepared itself by meeting more frequently (while resources were being mobilised), gathered all information possible about Bangladesh and the cyclone, trained by learning from other Volags who had been to other disasters earlier and made positive efforts to know each other better viz. 'team building'.

b) *At Bangladesh:* We were separated and could not function as one team due to local exigencies and the differing needs on site. The major groups of volunteers working at Bangladesh were:—

- i) Students—who were very helpful in rescue operations, census, documentation and general volunteer duties in all areas,
- ii) A federation of development agencies who operated in phases I and II mentioned earlier,
- iii) A federation of health agencies who were mainly involved in health work along with the other groups, and
- iv) Organisations like the Gonoshostya Kendra which integrated all activities (health and development) in their approach.

The experiences of Volags in the past which helped build up this paper were the Bangladesh refugee camps in 1971; the Bhopal gas tragedy; the Andhra cyclone and floods; the drought in Karnataka and the Bangalore liquor and circus fire tragedies.

#### **Essential of the Volag Responses:—**

Voluntary agency responses are straight from the heart, and take an activist approach. They are motivated:—

- to mitigate suffering
- to be responsive to emerging needs
- to be involved in all phases of disaster management at all levels
- to learn as it proceeds, and
- to have a positive bias to the most needy. Some additional features of the responses have been;

issue raising to make people becoming aware; keeping issues alive, as in Bhopal; research of cause and effects of a disaster eg. Karnataka drought/Bhopal; lobbying for justice —eg. Bhopal planning for future disaster management e.g. PREPARE/ARTICLE etc.

#### **Lessons Learnt:—**

##### **1) *Pre-disaster, Disaster, Post-disaster continuum:***

All conditions which existed before a disaster are likely to exist afterwards, in a more acute form, whether they are medical, social, economic, political or whatever.

##### **2) The worst affected are the most needy; these comprise of the socio-economically backward; women, children and the aged, and destitutes and daily wage earners.**

##### **3) People response to disaster depends on their level of awareness:**

People try to seek safety and evolve a quick adaptive response at personal, family, social and community levels.

Some behaviour patterns, expected like panic flight, helplessness, paralysing trauma, anti-social behaviour and a shattered community are just myths.

##### **4) The family is a basic and the most important coping mechanism that people have.**

##### **5) There is an intense need felt for information about disaster victims/secondary threats/emergency needs/emergency activities-by the people.**

Such information helps to reduce uncertainty and promote positive action.

##### **6) *Psychological response:* A majority of the people show a stress reaction, with no incapacitation or long term impairment.**

People go through phases of heroic feeling, anguish, disillusionment and recovery. The time taken in each of these phases is variable in individuals.

##### **7) *The training needs:* Of disaster relief workers are in areas of: Skills—First aid/Public health/Epidemiology/Psychosocial skills/Team building Attitudes—to tackle the situational characteristics of a disaster, such as a) great uncertainty; b) urgency; c) need for adaptability, d) loss of autonomy and e) changing basis of participation. These are needed at all levels of training.**

##### **8) *Public awareness*—is directed to people living in disaster prone areas, so that they are aware of**



the risks; secure the know how to mitigate loss; and, are able to build their own processes to face future disasters.

The characteristics are: a) the process has to be ongoing; b) participatory; c) community specific; d) risk specific; e) target population specific and f) should be an integral part of the warning and the response systems.

9) A general assessment:—

*Volag Response:*

*Weaknesses are:*

- small size/reach
- ideological priorities

- resource constrains and
- variable relationship with Government agencies.

*Strengths are:—*

- commitment/aesthetic approach
- sensitivity
- adaptability
- informal approach
- participatory and appropriate responses, which help mobilize people, since their focus is always on increasing awareness.



# COMMUNITY DISASTER PREPAREDNESS — THE PREPARE WAY

*Dr. Jacob D. Raj*

## **Introduction:**

It is generally assumed that disasters and emergencies can be dealt with only by the state and the central governments and by the military in extreme situations. No doubt in the past few years the state machinery has vastly improved its capacity to respond to emergencies, yet there still exist, crucial gaps which the government alone is unable to resolve. It is these aspects that need to be addressed before we lie content as being well prepared.

PREPARE, a national voluntary agency involved in disaster preparedness has reasons to believe, based on its past experiences, that local communities do have the best possible capability to play an effective role in reducing the impact before and after disasters. A community with preparedness abilities and capabilities could save the lives during the first few critical hours when life is at risk and before any help reaches from outside. PREPARE firmly believes that the primary level mitigation could and should be handled by the local communities themselves whereas the problems requiring specialist and expensive resources can be handled by the government and the external institutions.

In fact, our experience confirms that a well prepared community actually facilitates an enhancement of the quality of the outside assistance and also aids in a more appropriate and economical use of the resources.

As part of its strategy to emancipate the poor, PREPARE is deeply committed to fostering community preparedness as disasters affect largely the life of the poor who are ill equipped to deal with emergency events. The poorest of the poor are often found living in low lying areas, on the banks of the rivers and at the foot hills where the magnitude of disaster impact is the maximum. Increasing frequency of disasters they have to face has blocked their very survival and the livelihood and has also pushed them to social bondage, economic in-

debtedness and lack of political power and will to control their own lives and resources. Hence within the overall strategy of development it is all the more necessary to promote and support community preparedness to establish justice for the poor, creating thereby a climate in which the vulnerable people themselves take action and not merely abide by the action taken on their behalf. Their traditional, merely reactive approach should be changed and replaced by mitigation strategies by integrating the necessary alterations within our development policies.

## **Assumption and endeavour of PREPARE:**

As a pioneer in community preparedness action in India, we have learnt over the years that disaster impact reduction has been traditionally a local responsibility. Families in rural communities have held hereditary role, responsibility and authority to defend themselves from disaster impacts. They have sacred beliefs in their social institution which has the knowledge and collective memory handed over from generation to generation to protect their community from death and suffering and also to prevent further calamities.

The present day socio-political and modern dominant ideologies have brought a sweeping change in the structural communities where their traditional mechanism of planning preparedness is broken and their collective knowledge and memory interrupted.

Based on these assumptions and in the context of the present day emergency realities PREPARE has endeavoured to approach disaster preparedness with a twofold strategy:

- a) Reviving past memory, developing new knowledge information systems and institutionalising them at the community level.
- b) Establishing an informal training network in the villages with the involvement of



NGOs and developing preplanned protective action for and by every community in the entire region of the Bay of Bengal.

#### **Formation of task force:—**

Community preparedness involves understanding of the threat, preparing operational plan to deal with likely scenarios and training and reviving or developing organisational structure in the local community.

PREPARE has an ongoing community disaster preparedness programme in about 200 coastal villages in Tamil Nadu and Andhra Pradesh. This programme is being extended to the flood prone areas of Bihar, West Bengal and Orissa.

Task Force Formation in the villages is our effort to consolidate human force and provide necessary identity and skill and to classify role, responsibility and also create institutional collective memory.

This stage has in fact also more dimensions of human interaction and PREPARE has therefore formed 176 task force groups so far. A task force normally comprises of a minimum of 11 members and a maximum of 21 members depending on the size of the local population. There is no age bar, but youth between 16–35 years and women are preferred. The physical mobility and motivation of the selected members are the deciding factors.

The task forces have the social sanction from the community and therefore have an authority. They develop contingency plans and issue instructions to family members as to what every vulnerable member should do to be safe in times of emergencies. They also prepare the community to be ready with their protective action plans. The task force members function as local organisations in a co-ordinated manner and guarantee their people that the situation is under control without panic or fear.

#### **Training network:—**

Training is crucial because the youthful members of the task force act not only as a means of contact between the Government and the village but also regularly take on a life of risk for them-

selves and their communities. Hence the training component and skill base is specially designed for them with suitable adaptability. The training itself is found to be a motivating factor as the training imparted is innovative and simple. PREPARE strives hard to simplify the sophisticated techniques and instruments to suit local needs. The training is also carried out in phases, constantly experimenting with close attention to the adaptability of each technique and equipment to the local requirements. Trainings are tailored to equip the task force members to use the skill during any emergencies—such as house collapse, fire, flood, snake bite etc. Training emphasis is on contingency plan, warning systems, mastery in evacuation emergency medical care, camp organisation, water, sanitation and food preservation. Members are also trained in leadership skills and protective planning.

#### **Preparedness skills:—**

Indigenous methods and materials are the key aspects in rescue operations using locally available materials like ladder, jerry cans, bamboo, ropes, gunny bags etc. The team, under the co-ordination of the task force group leader reaches out and rescues the most vulnerable people without losing time. The evacuation routes are predetermined by them and also kept strengthened so that smooth evacuation is always effected. As the local community has already watched them practising their skills, people are highly confident in the ability of the group to save their lives.

Emergency medical care is provided by the task force members. They are equipped with the necessary skills to handle minor injuries, respiratory problems and transport the victims in the safest possible manner.

In the aftermath of a disaster, task force members ensure water supply by creating new supply points.

The community is sub-divided into groups of families and each group is assigned a particular task to work along with a task force member. Some examples of the tasks are: making temporary sanitary arrangements, arranging for water supply, keeping food preparations ready etc.

The task force groups periodically evaluate the



possible shelters. They are trained in assessing structures damages to houses, crops and livestock. They help on the spot and also contact the government officials in planning post-disaster assistance such as in house repairs, rebuilding embankments etc.

Task force groups are also trained in developing entire village contingency plans. They see to it that this plan is complete in all respects including resource points within the village (food, shelter, transport, health, communication etc.), problem areas (obstacles in exit routes, people needing assistance during evacuations) and responsibility allocation (group of families involved in sanitation, food preparation etc.) and so on.

They use the taluk, mandal and revenue village maps as their basis and a 5 km radius sketch plan is then developed for each village. Care is taken to clearly highlight landmarks and approach routes surrounding the village. Elders and youth of the village are involved and detailed discussions are held to pinpoint the direction, the distance and the specific routes to the nearest shelters, the telegraphic office, the government officers etc.

A detailed layout map of the village—indicating residences of the people, low lying areas, high-lying areas and other structures is prepared by the group. The plan also indicates the presence of the most vulnerable population such as the sick, the elderly, the pregnant women, the disabled and the infants in each household. Besides the 5 Km radius map and the village layout map, other plans are also prepared by the group indicating responsibility allocations.

#### **NGO involvement:—**

The entire Bay of Bengal region is disaster prone and to develop preparedness capability among the vulnerable communities living in this vast stretch of sea coast requires an involvement of hundreds of NGOs for a considerable period of time. With a view to cover the maximum area, PREPARE conducts regular training to NGOs. The participants are generally the staff of the voluntary agencies. More than 300 staff from 65 NGOs are trained so far. NGOs interested to develop formation of task force groups and pre-planned protective action in their target villages are

assisted with continuous training support. PREPARE conducts areawise reunion of meetings once a year for all the NGO staff and the task force members. This meeting known as Alumni Contact Programme is aimed at building an informal network among the NGOs and task force groups with a sense of solidarity among them and offering an opportunity to exchange their views besides providing a venue for updating their skills.

Some of the task force members are identified as trainers and are provided with additional training. Such an identification is based on their experience, motivation and expertise in various skills and very importantly on their ability to train others in turn. There are about 15 task force members who are now graduated as trainers in this way.

#### **Information/Communication:—**

It is encouraging to note that there are many institutions in Europe, USA, Australia and in Caribbean countries involved in research as well as information, documentation and dissemination relating to disaster reduction. The situation in India is however dismal and there does not seem to exist any interest among any university or institution to fill this vacuum. The information from the West although noteworthy, is not readily usable in community preparedness among the largely illiterate, traditional and ritual oriented society in India.

PREPARE considers that knowledge and information has legitimacy only if it has practical use to those who actually deal with disaster reduction and the community groups who are vulnerable. PREPARE accordingly brings out every quarter a task force bulletin and newsletter in Tamil, Telugu and English. This is used as our information/communication medium linking every task force member and NGO. This information system is maintained in order to update their knowledge on various skills and techniques exposing task force to the new and the latest information on disasters. Sharing of experience benefits all the members and enables a two way communication between the task force members. For NGOs it enhances their morale and also motivates their usage of PREPARE bulletin as a medium of distance education. As on date, PREPARE communicates with 175 NGOs in five states and about 200 task force groups.



A practical trainer's manual in disaster preparedness was brought out in English, Tamil and Telugu recently. The overwhelming requests for copies of this manual coming from all over the world is a clear evidence that no practical reference manual has been published to date for the guidance of emergency workers and managers for their ready reference.

Disaster reduction in India will be seriously hampered if right information/knowledge and training material is not developed. It is a main challenge of PREPARE to make that the disaster mitigation knowhow becomes peoples' do-how and thus reduce the suffering caused by natural disasters.



## EXPERIENCES FROM CYCLONE RELIEF WORK IN ANDHRA PRADESH—1977

*Dr. P.N. Pandit*

On the 19th November 1977 a severe cyclonic storm and tidal waves of unprecedented magnitude hit the eastern coast of India over central Andhra Pradesh. A.I.R. and news paper reports gave a grim picture about the loss of life and property in the cyclone hit area.

The staff and students of St. John's Medical College, Bangalore decided to send teams of volunteers to work in the disaster hit area of Andhra Pradesh.

The first team of 10 volunteers comprising of 9 doctors and one paramedic, led by the author left Bangalore on 1st December 1977 to Vijayawada. We had limited funds and a few boxes of medicines at our disposal. Due to lack of proper communications, we had hardly any guidance or co-operation from the local authorities and other voluntary agencies at Vijayawada. On our own initiative and quick survey, we decided to work in the tidal wave hit Divi taluk of Krishna district. We associated with the Catholic cyclone relief committee, who provided us a base and a banner to work under. A group of villages were identified and adopted for our medical relief work.

Several other voluntary organisations along with the State and Central Governmental agencies were already working in that area. However, none of the organisations had their men stationed in the midst of the disaster hit area. We realised that a lot of time was wasted in their travel up and down, reducing their effective working time to a few hours, in a day. Hence we decided to live in the area of work to avoid wastage of time on travel. More over we did not have any transport at our disposal.

We also saw the relief material being dumped in a central area without effective and proper distribution resulting in a free for all. We decided to carry relief and service, wherever it was needed. Lack of transport facilities and damaged roads were of a great hindrance to start with.

A cyclone relief base camp was set up in a paddy field at the periphery of the tidal wave hit zone, at Nagayalanka. It had three main constituent teams for relief work, rehabilitation and medical work. The first field clinic was set up in the midst of the disaster hit area, at Mandapakala. Later on, more such field clinics were established. A part of the medical team was constantly moving from place to place and house to house, rendering on the spot medical relief. We called this a mobile team. The field clinics were established, entirely, with our own efforts. Once they were established people used to just walk in. Possibly the shock of the tragedy around them, made the local population totally paralysed in action.

We depended for medical supplies mostly on our own resources. Governmental agencies helped us, once our credentials were confirmed. We could establish a Rapport with them, only after we started submitting daily reports on our activities to the local authorities. From the beginning we maintained accurate records. On an average 300-400 people were attended to every day in the early part of the operations. On the whole, over 10,000 people were rendered medical aid between December 1977 and February 1978, when the medical teams were recalled back to Bangalore. Four medical teams worked by rotation during this period.

Treatment modalities and drug schedules had to be altered to suit the local demands and available resources. Several improvised methods of treatment had to be used due to lack of proper equipment, especially in the treatment of fractures and dislocations. Evacuation of casualties to bigger hospitals was our greatest problem, in the absence of proper roads and transport facilities.

More than 40% of the people used to come to our teams, just for a word of sympathy and encouragement, than for any real medical problem. Respiratory infections and chest injuries formed the largest group of medical problems treated by us.



As a result of this experience, we felt the necessity of advanced planning and preparedness to work in disaster hit areas. Transportation was a big hurdle, especially in the interior. Establishing camp, after selecting a place, takes a lot of time. Lack of equipment and co-ordination hampers the efficiency of work. We had to use all modes of transport including tractor trailers to move around.

The functions of different medical teams may be classified as follows: In the base camp at the periphery of disaster hit area, the team had to look after the supplies and liaise with donor agencies, in time, to avoid any shortfall. They had to prepare reports and regularly reach them to the donor and Governmental agencies. They had to run a base clinic, where patients from field clinics were managed. Base clinics had to look after the medical needs of volunteers as well and maintain the camp sanitation.

The field clinics had to be inside the disaster hit area. Basically they had only two functions (viz) curative aspects of various injuries and diseases and to prevent communicable diseases, from occurring and spreading. The mobile teams of doctors and nurses were only complimentary to the field clinics and they carried out the curative and the preventive aspects of care to the door step of the disaster struck people. They had to carry out other miscellaneous work also like disposing of the dead bodies etc.

The lessons learnt by our experience may be summarised as below:—

The medicines and equipment carried should include antibiotics, antidiarrhoeals, antispasmodics, analgesics and antipyretics. Steroids, antihistaminics, vitamin preparations and cough mixtures may also be included. Other useful items are vaccines and tetanus toxoid, intravenous fluids, syringes, bandages and surgical instruments for minor procedures.

To tackle the problems in future disasters, an

infrastructure has to be built up and kept ready at all times. This should consist of trained volunteer doctors and paramedical staff. There should be designated leaders and officers in charge of different teams. These teams should be able to assemble at a central point at short notice and mobilised quickly. Central supply points should be established and well stocked at all times. Transport facilities must be provided to the volunteer force. They should also be given essential camping equipment and survival training. Last but not the least, a clear line to the source of funds has to be drawn and this line should be kept alive and active at all times. A course of disaster medicine may be included in the curriculum of students both at the undergraduate and post-graduate levels.

Clear cut disaster plans should be drawn up and they should be updated periodically. These should include plans to tackle large numbers at short notice, utilising limited resources; transport bottle necks must be avoided. The volunteers should be trained to handle people under stress. They should also have an understanding of the local socio-religious and cultural structure. The volunteers should be able to work with meagre amenities and co-ordinate with others working in the area. Lines of communication must be maintained at all costs. Standardisation of procedures avoids wastage of material and time. Standard treatment for common disease groups has to be planned. The routine hospital work and treatment schedule may have to be modified to suit the requirements of the local area. Cases have to be sorted out and a standard procedure for evacuation of serious casualties has to be planned. The volunteers have to be trained to counsel and give empathy to the disaster hit people.

For the volunteers, packed food and supplies must be provided. They should be immunised and protected from possible communicable diseases. Replacement teams must be kept in readiness, as a single team may not be able to work continuously for more than 3–4 weeks at one stretch.



# ROLE OF STATISTICAL TECHNIQUES IN QUANTITATIVE RISK ASSESSMENT

*A.W. Deshpande*

## 1.0 Introduction:

Environmental risks are inherent in design and operation of large and complex industrial units. Accidental releases of toxic or flammable gases due to any major or minor failure in the plant sections could lead to a disaster resulting in heavy toll of human life and devastating losses to ecology and property. Probabilistic Risk Assessment (PRA) coupled with Probabilistic Safety Assessment (PSA) is considered essential in the present context of rapid industrialization.

Risk Assessment which is a subset of safety analysis, requires consideration of the probability of an accident occurring and its subsequent consequences. In answer to the question "Why perform risk analysis?" at least two reasons come to mind easily. First, the management has a mortal obligation to design the safest possible system (with the lowest probability of system failure and minimal consequences if the system does fail) within the given set of engineering constraints (such as overall cost, available materials, available personnel) and equipment, etc. By performing a risk analysis, we may obtain sufficient information about the system to redesign it and lower the probability of the occurrence of an accident or mitigate the ensuing consequences. Alternatively, it may be possible to show that the probability of occurrence is negligibly small. Second, we perform a risk analysis of an engineering system to obtain information useful in a comparative risk assessment.

## 2.0 Approach:—

Risk involves the occurrence or potential occurrence of some accident consisting of an event or sequence of events. Fig. 1 depicts a conceptual framework of any quantitative risk assessment studies while Fig. 2 present a procedure commonly practiced for Hazard Study (HS) and quantitative Risk Assessment (QRA) for any chemical process

industry. The sub tasks of the various phases involved in HS and QRA are described in the following section.

## 2.1 Phase I: Maximum Credible Accident (MCA) Analysis:—

MCA stands for Maximum Credible Accident or in other words, an accident with maximum damage distance which is believed to be probable. MCA analysis does not include quantification of the probability of occurrence of an accident. In practice the selection of an accident scenario for MCA analysis is carried out on the basis of engineering judgment and expertise especially in the field of accident analysis (Fig. 3).

Process information study and the relevant data would help in the identification of hazard prone sections of the plant. Inventory analysis and Fire and Explosion Index (FEI) and Toxicity Index (TI) are the methods used in hazard identification. Release of chemicals in the atmosphere from the identified hazardous section is then studied by visualising accident scenarios on the basis of the properties of the chemicals. The consequence of such a release is calculated in terms of damage distances. This study helps in plotting the damage contours on the detailed plot plan of the unit in order to visualise the consequence of occurrence of a particular hazardous event.

## 2.2 Phase II: Hazard Analysis, Assessment and Evaluation:—

Ranking of each unit in hazard prone sections is done based on the FEI, TI and Inventory Analysis. Safety of less hazard prone sections is studied using checklist approach while a detailed Hazard and Operability (HAZOP) study is carried out for the most hazardous sections.

The purpose of HAZOP studies is to detect



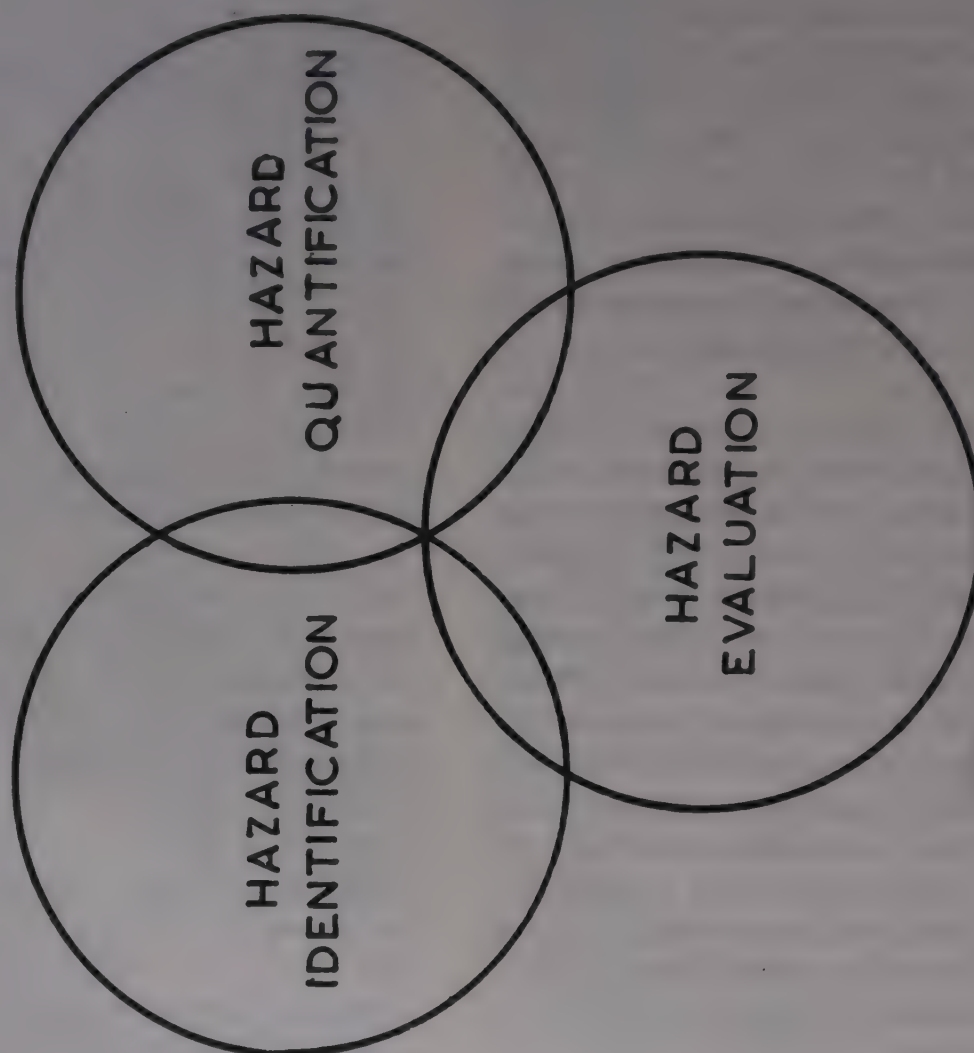


FIG.1. CONCEPTUAL ACTIVITIES : HAZARD STUDY AND RISK ANALYSIS.



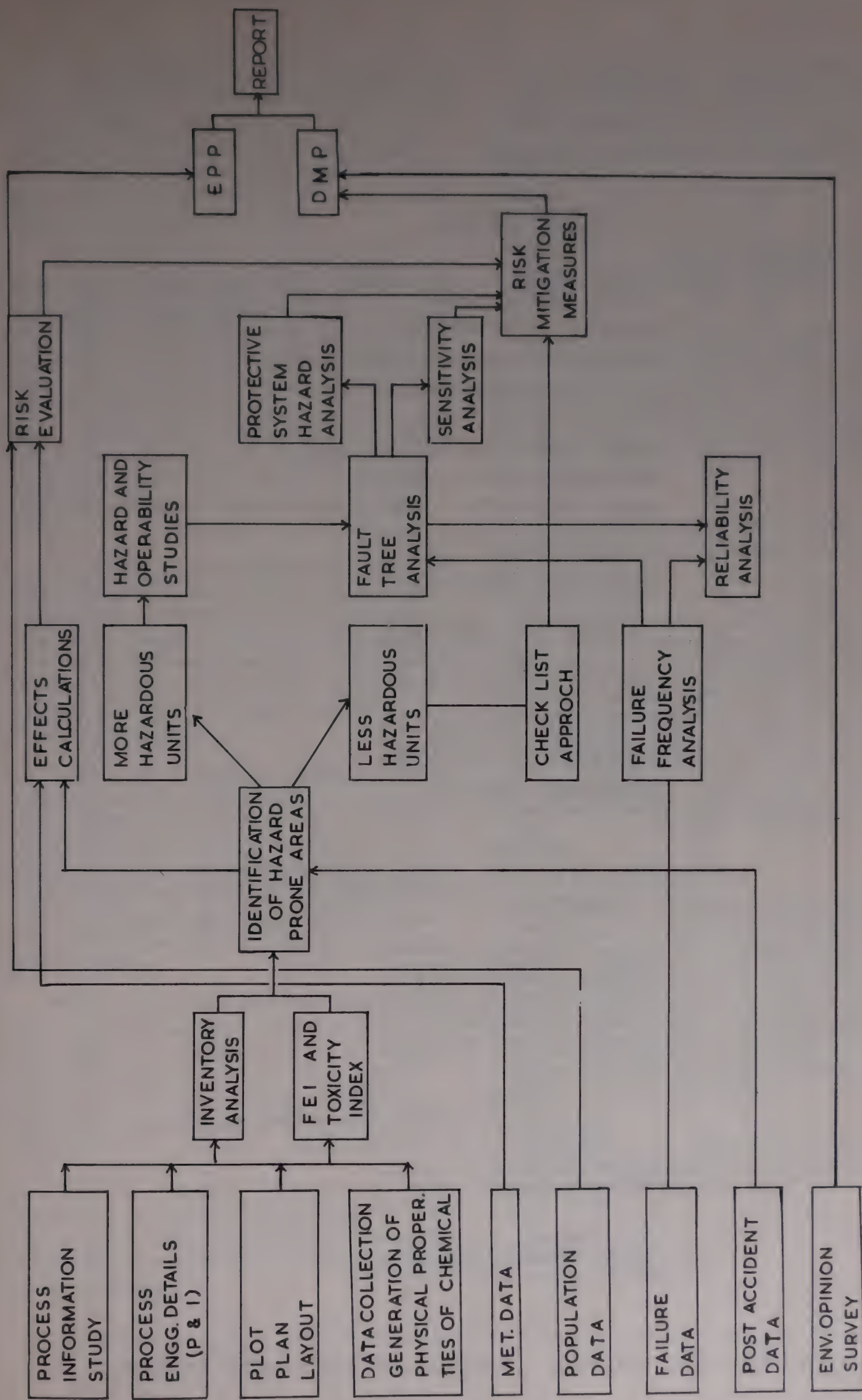


FIG.2. COMPREHENSIVE RISK ASSESSMENT AT A GLANCE



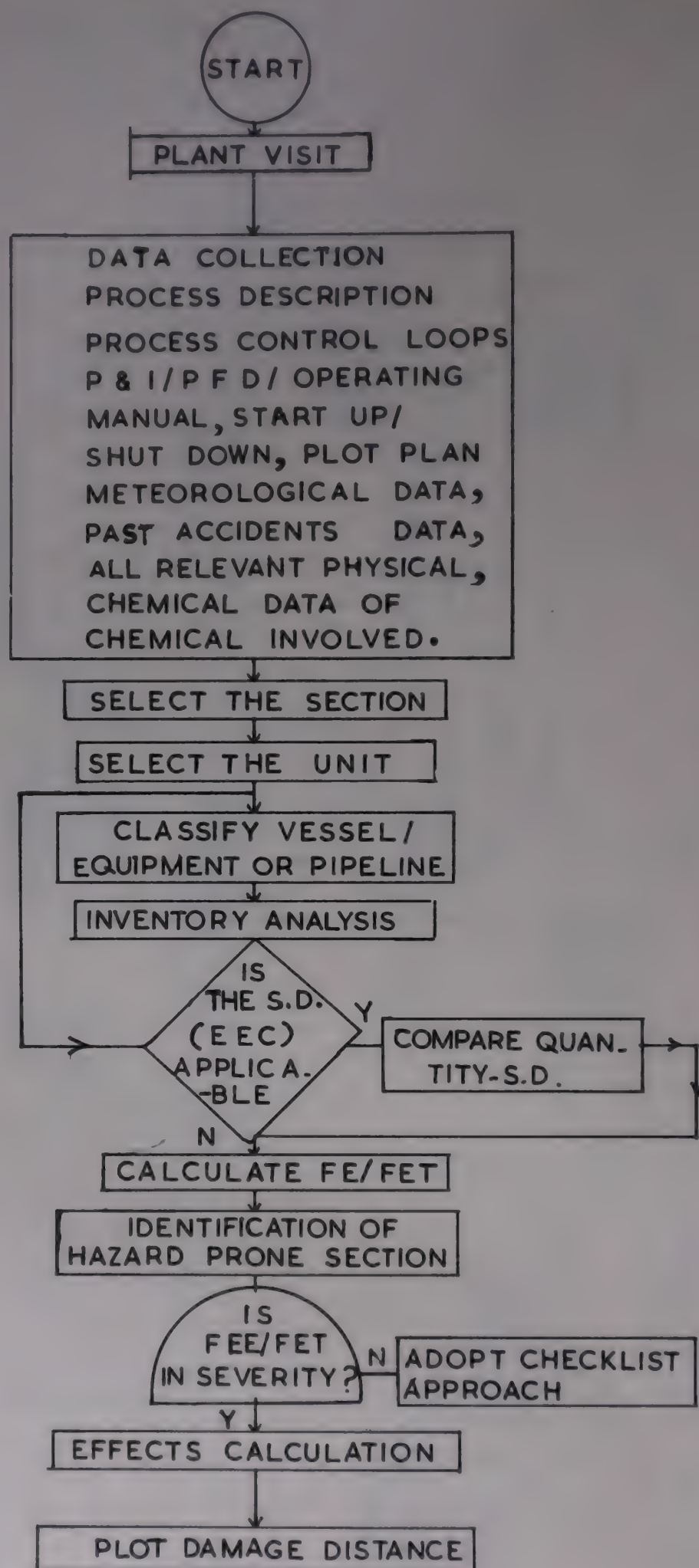


FIG.3.FLOWCHART FOR MAXIMUM CREDIBLE ACCIDENT (MCA) ANALYSIS ,



any predictable undesired event in a process to achieve a systematic study of the operations carried out for each process step involved and also the way in which the various components involved interact. This exercise is particularly important in the case of processes for which there is no or only limited actual operating experience.

The principle of the technique is to discover factors preventing the system under consideration from performing the intended decision. Creative thinking results in the discovery of deviations from the intention of the decision. The creative process of thought is substantiated by the use of Guide Words. HAZOP studies indicate all the possible events and their consequences. In multicomponent systems such as chemical plants, it is important to analyze the possible mechanisms for failure and to perform probabilistic analyses for the expected rate of such failures.

Fault Tree Analysis (FTA) is a technique by which many events that interact to produce other events can be related using simple logical relationships which permit a methodical building of a structure that represents the system. Majority of the primary events that could lead to the failure of a unit (known as top event) could be derived from HAZOP studies.

Application of reliability engineering especially in the process control instrumentation is of recent origin. System performance can be evaluated by the assessment of pathway reliability of each vulnerable process section. The quantitative estimation of pathway reliability helps in deciding reliability improvement strategies. Probabilistic Safety Assessment is carried out by estimating plant reliability.

Whilst the quantitative assessment of reliability (or for that matter estimation of top event probability of an occurrence of an event using Fault Tree Analysis) uses mathematical theories, it is hindered in practice by the lack of failure rate data from chemical process control instruments/equipments.

Protective system hazard analysis gives an insight into the protective system provided at the section. Safety valves, rupture discs, sprinklers are some of the common protective systems used in any chemical industry.

Evaluation of risk and plotting of individual and societal risk curves and iso-risk contours are aimed at estimating risk levels. These technological factors in association with environmental opinion survey could lead to arrive at an appropriate risk ranking.

### 2.3 Phase III & IV: Disaster Management Plan (DMP) and Emergency Preparedness Plan (EPP)

Safety review of specially vulnerable process units is covered in this phase. This helps in reducing the risk qualitatively while the outcome of phase I and II would reduce risk in quantitative terms. Risk reducing measures using engineering judgment, risk contour and reliability approach form an integral part of DMP.

Onsite and offsite emergency preparedness based on the earlier studies are also covered in this activity.

Interpretation and laws of probability, collection of instrument/equipment failure data and error analysis are of vital significance in conducting QRA studies. System reliability studies help in improving the safety of an unit in quantitative terms. Annexure I gives some of the important expressions while computing the probability of occurrence of an undesired event such as release of a hazardous chemical from storage tank.

### 3.0 Some Useful Expressions:—

The purpose of collation of failure data for the instruments/equipment is of vital significance in order to estimate the Top Event Probability (TEP) of an undesired event using Fault Tree Analysis (FTA). System Reliability is another aspect which helps in improving plant safety. It is, therefore, appropriate to write down mathematical equation which have direct bearing on the estimation of TEP and reliability.

Reliability is the probability that a system performs a specific function or mission under given condition for a prescribed time.

Mathematically,

$$R(t) = 1 - F(t) \dots\dots\dots (1)$$



in other words  $F(t)$  is the unreliability that the device or system fails at some time between 0 and  $t$ , and  $R(t)$  is the probability that it will not fail during that time period.

The following are the expressions:

$$f(t) = \frac{dR(t)}{dt} \dots \dots \dots (2)$$

$$(t) = \frac{d \ln R(t)}{dt} = \frac{1}{R(t)} \times \frac{dR(t)}{dt} = \frac{f(t)}{R(t)} \dots (3)$$

Integration of equation (3) gives

$$R(t) = \exp \left[ - \int_0^t \lambda(t') dt' \right] \dots \dots (4)$$

Combining equations (3) and (4) leads to:

$$f(t) = \lambda(t) \exp \left[ - \int_0^t \lambda(t') dt' \right] \dots \dots (5)$$

In the above expressions  $(t)$ ,  $R(t)$ ,  $F(t)$  and  $f(t)$  are described as hazard rate, reliability, cumulative failure probability and failure probability density respectively.

The concept of Mean Time to Failure (MTTF) of a component (e.g., pressure safety valve) is commonly used while computing the failure rates.

$$MTTF = \int_0^\infty R(t) dt \dots \dots \dots (6)$$

The MTTF is especially simple in the case of random failures since

$$MTTF = 1/\lambda \dots \dots \dots (7)$$

The terms commonly in vogue are RAM, Reliability, Availability and Maintainability. Study of Probability Distribution for describing failures

of a component (invariably) termed as Distribution fitting) plays an important role while analysing component failure data. Exponential, Weibull, Poission are some of the important distributions used in reliability engineering.

$$R_s(t) = R_1(t) \cdot R_2(t) \dots \dots \dots (8)$$

Components in active parallel

$$R_s(t) = R_1(t) + R_2(t) - R_1(t) \cdot R_2(t) \dots \dots (9)$$

The analyst is, therefore, left with an option of utilizing appropriate statistical tool and estimate the TEP of an undesired event in quantitative risk assessment studies.

It is true that probability theory is an important tool while estimating TEP of an undesired event (such as release of hazardous chemical from storage tank) but the recent trend is towards the application of possibility theory using Fuzzy Sets theory concept.

#### 4.0 Summary:—

The consequence of an accidental release of hazardous chemical from the process unit/transfer line or storage would lead to a catastrophe. It is therefore, important to the management to estimate the probability (or more precisely the possibility) of such an event. The state of the art in vogue is to use statistical techniques for the estimation of probability of occurrence of an accident though research studies are being reported in favour of the use of possibility theory. Use of these techniques also helps in suggesting risk mitigation measures by adopting risk contour or reliability approach.



# TROPICAL CYCLONE—DETECTION AND WARNING SYSTEM

*G.S. Ganesan*

## 1. Introduction:—

Among the natural disasters, tropical cyclones occupy the primacy of position in causing deaths and devastation (Table 1). As atmospheric systems go, they may be said to occupy an intermediate position on the basis of spatial, temporal and energy states (Table 2).

## 2. Definition of a cyclone:—

One would have noticed the use of words like “depression”, “deep depression”, “cyclonic storm”

etc. in the weather bulletins. These terms have a precise technical connotation (Table 3). They all refer to atmospheric systems with a centre around which two or more isobars (lines connecting equal pressure) on a horizontal surface would be closed. The air masses moving around the centre at any instant would have the characteristics of a spiralling inward flow towards the centre and this is so, apart from the vertical motion. Depending upon the strength of the wind, the system is called ‘depression’, ‘cyclonic storm’ etc.

TABLE I

**Types of disaster and the number of deaths**

Type of disaster	Death (average/year)
1. Tropical cyclones ..	14,700
2. Earthquakes ..	13,250
3. Floods ..	5,700
4. Thunderstorms ..	
Tornadoes ..	850
5. Snowstorm ..	300
6. Volcanoes ..	250
7. Heatwaves ..	200
8. Avalanches ..	150
9. Landslides ..	150
10. Tsunamis ..	150

(Adapted from a WMO publication)

TABLE III

**Nomenclature of Cyclonic systems**

Name of the system	Wind speed
Low pressure	< 17 knots (< 32 kmph)
Depression	17–27 knots (32–50 kmph)
Deep Depression	28–33 knots (50–61 kmph)
Cyclonic storm	34–47 knots (61–87 kmph)
Severe Cyclonic Storm	48–63 knots (87–117 kmph)
Severe Cyclonic storm with core of hurricane winds	64 knots (117 kmph)

TABLE II

**Approx. K.E. of various sub-systems**

Sub-system	Associated K.E. (ergs)	10% of this energy as equivalent to combined total U.S.A. energy produced in.
Tornado	$10^{21}$	0.5 minutes
Small Thunder storm	$10^{22}$	5 minutes
Large Thunder storm	$10^{23}$	5 hours
Hurricane	$10^{25}$	5 days
Extra tropical cyclones	$10^{26}$	5 weeks
General circulation	$5 \times 10^{27}$	5–6 years



### 3. Nomenclature:—

Tropical cyclones are known as hurricanes in the Atlantic and Eastern Pacific, typhoons in the Western Pacific and bagius in the Philippines. It is interesting to note that cyclone is derived from the Greek root which among other things means the coils of a snake!

### 4. Frequency of occurrence of tropical cyclones:—

About 80 cyclones occur in a year over all the ocean basins. 33% of them occur in the Northwest Pacific and 7% in North Indian ocean basin. During the period 1891-1990, 19 cyclonic storms and 21 severe cyclonic storms have crossed the east coast of India between Latitude 10°N and Latitude 14°N. A month-wise distribution of storms in the Bay of Bengal and Arabian sea can be shown (Table 5).

### 5. Life time of a cyclone:—

The tropical cyclone has four stages during its life: (i) Cyclogenesis, (ii) Intensification, (iii) Maturity, and (iv) Dissipation.

i) Cyclogenesis: The parameters that favour the cyclogenesis are many. One important parameter relates to sea surface temperature. There is a threshold temperature of 26.5°C below which cyclogenesis does not takes place.

ii) Intensification: The cyclonic disturbance is said to intensify if the pressure gradient in the vicinity of the centre of the system increases with time. (Pressure gradient means difference in pressure divided by the distance normal to isobars on a sea level surface). It may take from several hours upto about a week for a system to reach intensity.

In the insipient stages of the disturbance, active, convective thunderstorms and moderate rains occur in the areas of disturbance. The transfer of sensible heat and of water vapour from the ocean increases cumulus convection and hence the latent heat release and upward motion. This

TABLE IV

#### PROPERTY DAMAGE

Disaster Type	Loss (in a year) (Rupees)
Earthquake	2000 Crores
Cyclones	Generally 2000 Crores (INDIA) (6000 Crores in USA)
Floods	250 Crores (USA) 90 Crores (India)
Tornadoes	
Thunderstorms	3400 Crores (USA)
Lightning	1000 Crores (India)
Hail	

TABLE V

#### PERCENTAGE STORMS MONTHWISE IN BAY OF BENGAL AND ARABIAN SEA

Month	Bay of Bengal	Arabian Sea
January	1.4	2.0
February	0.3	—
March	1.1	—
April	5.2	5.1
May	10.7	16.3
June	9.6	15.3
July	10.5	3.0
August	7.2	2.0
September	8.8	5.1
October	17.1	20.4
November	18.7	25.5
December	9.4	5.1
Yearly Average	4.5	1.1



causes greater and higher level mass divergence and a low level mass convergence. As this process continues on the surface at the adjacent levels, pressure falls rapidly and the pressure gradient increases eventually, leading to a depression becoming a cyclonic storm and so on.

iii) **Maturity:** A mature storm has the following characteristics:—

**A Structure:** It is composed of an eye, an eyewall region, an outer storm area and an area of weak cyclonic circulation. (Fig.1)

- a) Eye is the region of calm winds and of clear skies or skies with patchy clouds. Its diameter varies from 10 to 100 km (typically 40 km).
- b) Eyewall region: The eye is bounded by an eyewall region. It is in the eyewall region that the strongest convection occurs. It is here only that the strongest winds and the heaviest precipitations also occur. The eyewall may be 50 to 100 km away from the eye.
- c) Outer storm area: Beyond the eyewall region what is called rain-shield prevails. Here the wind strength and the rainfall activity gradually taper off as one moves radially outward. These may extend upto 150 km from the outer eyewall boundary.
- d) Area of weak cyclonic circulation: Beyond the outer eyewall boundary upto about 600 km from the centre of the storm, cyclonic circulation may prevail but the speeds get considerably reduced.

**B. Winds:** Air masses move anti-clockwise around the centre in the Northern Hemisphere. The winds have three components: 1) A tangential parallel to the circular isobars. 2) A radial component directed towards/away from the centre. 3) A vertical component (essentially, the updrafts).

The tangential wind reaches a maximum at about 1 km. level (typically 90 kmph in the eyewall region).

In addition to the tangential component, a radial component also prevails. Near eye-wall region it extends upto about 3 km, the maximum prevailing at about 500m (typical value 50 kmph).

Cyclonic circulation extends upto about 12 km above which level it is overlain by anti-cyclonic and radial outflow.

**C. Temperature:** The 'eye' region is the warmest and remains so throughout the troposphere. The value of temperature is the highest in the 'eye'. (10 to 12 °C above the surrounding average). The anomaly of temperature (possible departure from normal) is the highest near 14 km (about 15 °C above normal). The temperature gradient is the strongest across the 'eyewall' (1 °C/3 km); where the rain-shield dominates temperatures can be 10 °C or so less than in the 'eye'.

Such a pattern of temperature distribution along with the horizontal gradient persists upto very high level. The gradient becomes less pronounced at a higher elevation.

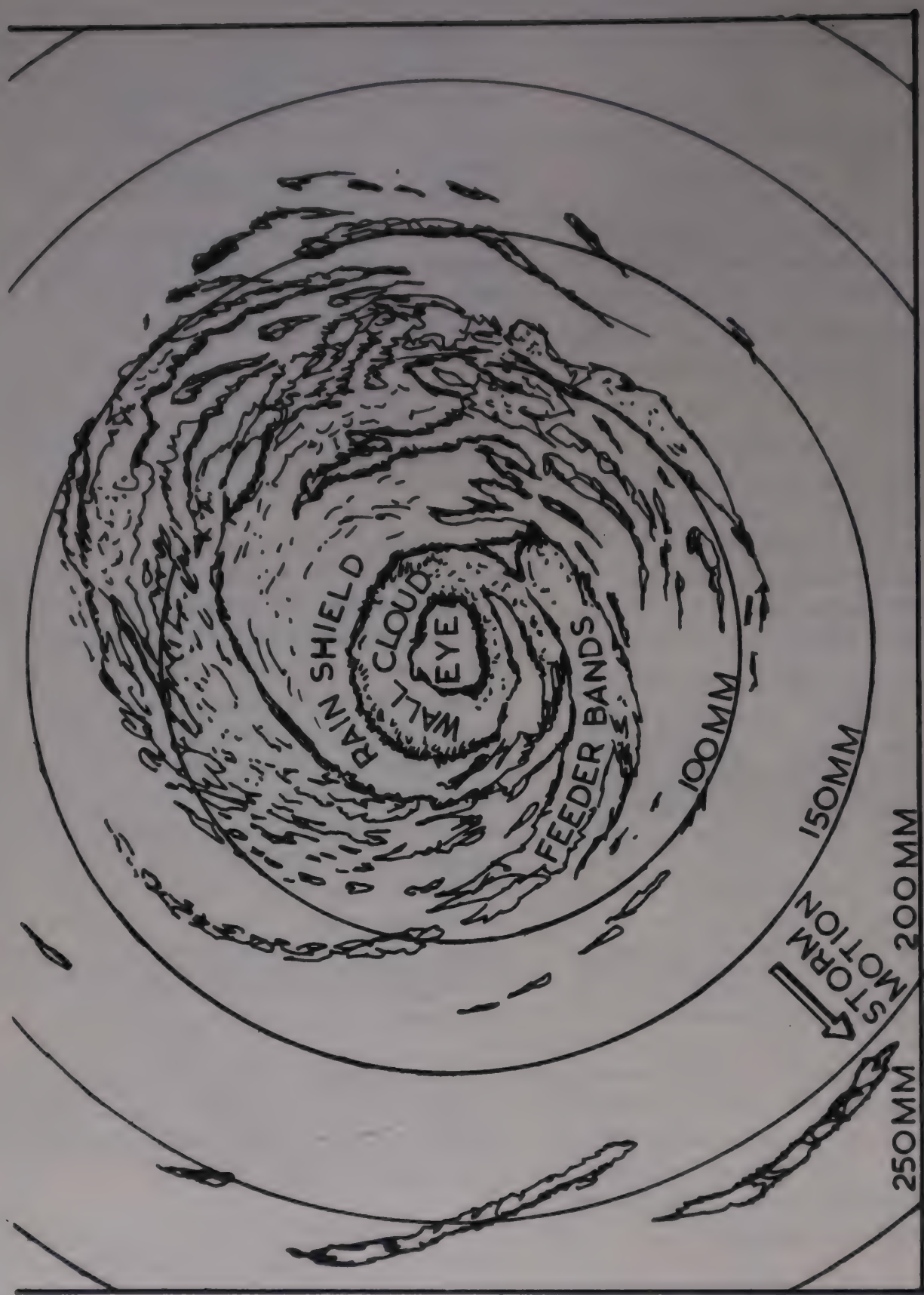
**D. Moisture and precipitation distribution:** The dominant cloud in the hurricane is cumulonimbus—thundercloud. The convective clouds cover the area near the centre of the storm. Beyond 100 km. radius they cover less percentage of the area under consideration. Rainfall upto about 200 km. radius is 10 cm/day, and in 200 to 400 km. range, it is about 3 to 4 cm/day. Though there is not much of an asymmetry in the rain around centre, the heaviest precipitation usually occurs in the right semicircle. Precipitation echoes occur in well defined spiral bands. The geometry may follow a modified logarithmic spiral  $r = r_0 + e^{a - b\lambda}$  where  $\lambda$  is azimuthal angle,  $r_0$  = radius of limiting circle and  $r$  is the radial distance of the band and  $a$  and  $b$  are the constants.

**E. Energy of storm:** About  $10^{25}$  ergs has been associated with a storm. This is equal to the electrical energy consumed by the United States continuously for about 50 days (Table 2).

**F. Dissipation:** The cyclonic storm is essentially fuelled by a latent heat of condensation of water vapour and the source of water vapour is the oceanic waters at high temperatures. When the cyclonic storm moves into colder regions or over land where the source of moisture is cut off, the cyclonic storm gets gradually weakened and eventually dissipates.

**G. Size of the storm:** The size of the cyclonic





SCHEMATIC DIAGRAM SHOWING IMPORTANT FEATURES OF A TROPICAL CYCLONE AS THEY WOULD APPEAR ON A RADAR PICTURE.

Fig. 1



storm as shown by the outermost closed isobar on the surface may vary from 100 km. to 2000 km. in diameter. The motion in the lower levels is along the rapidly contracting spiral with a relatively gentle ascent and in the upper level it is along a gradually expanding spiral. The speed of the storm is roughly 10 km. to 30 km./hr.

*H. Damage caused by storm:—* (Table 1)

- a) Damage due to wind: The pressure exerted by the wind on a structure normal to the direction of motion is proportional to the speed (Table 2 and Fig. 2).
- b) Damage due to pressure: Due to the passage of the storm, the pressure at a point falls. Also due to the enormous speeds of the winds, there would be a fall of pressure. Therefore tightly-sealed structures will collapse outwards.
- c) Damage due to rain: Excessive heavy rain and the consequent inundation.
- d) Damages due to storm surge: The most damaging action due to a cyclonic storm arises from the storm surge havoc. The oceanic level is raised typically upto about 4 to 5 metres above normal and even upto about 10 metres in extreme cases due to the passage of a cyclonic storm. This is brought about by:—
  - i) the pressure falls and the consequent inverted barometer effect,
  - ii) the persistent action of the wind on waves,
  - iii) the slope of the ocean bed near the coast,
  - iv) the coastal configuration, and
  - v) the tide factors.

The flood caused by storm surges normally affects upto 10 km. inland. In addition salt sprays will adversely affect the agricultural lands.

**Dissemination of the cyclone warning:—**

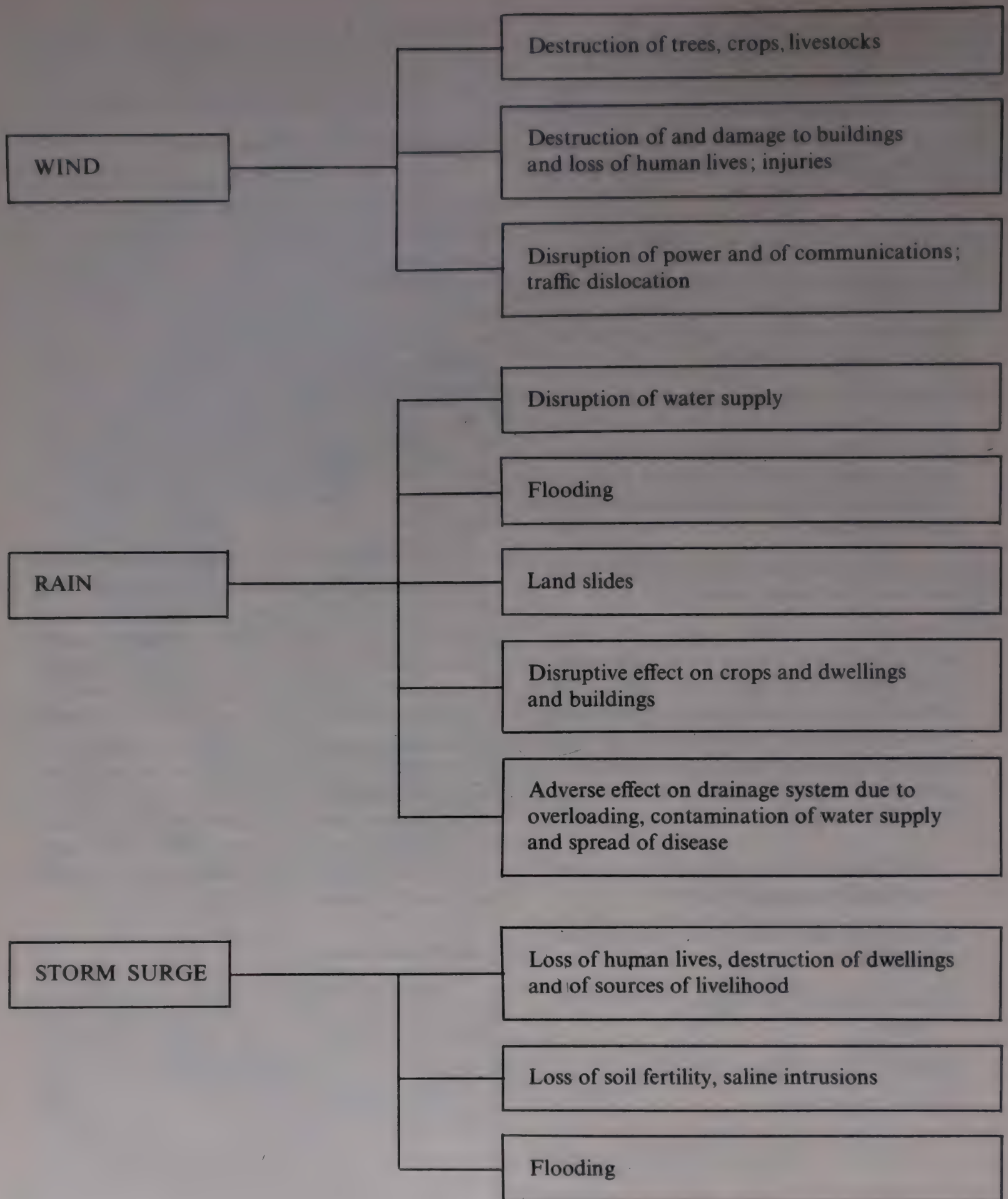
The Area Cyclone Warning Centres at Madras, Bombay and Calcutta and Cyclone Warning Centres at Visakhapatnam, Bhubaneswar and Ahmedabad of the India Meteorological Department issue bulletins in respect of cyclones. The weather data are collected from the oceans, and the adjoining countries through various communication networks like teleprinter channels, telex and fax facilities. They also have arrangement to receive satellite pictures of INSAT and NOAA. Besides this the radar network established on the coast of India does not allow any storm which comes within 400 km of the coast to go undetected.

48 hours before the commencement of the adverse weather associated with cyclone, cyclone alert messages are issued. 24 hours before the commencement of the adverse weather, cyclone warning messages are issued to the concerned government agencies. Cyclone bulletins are also broadcast through electronic media and published through print media. In addition, warnings are conveyed directly to the affected areas in regional languages making use of satellite communication link in what is known as Disaster Warning System. The concerned agencies responsible for the amelioration measures of the public must make the best use of the warning systems.

**Acknowledgement:—**

The author is grateful to Shri G. Arunachalam, Deputy Director General of Meteorology, Regional Meteorological Centre, Madras for his encouragement in preparing this note. Several articles of interest which appeared in various journals were consulted.





Types of potential damage accompanying Tropical cyclones  
(with modifications of a chart due to Southern (1975))

**Fig. 2**



# ROLE OF FIRE SERVICE IN DISASTER RELIEF

*V. Ananthasekar*

We in the Fire Service are living upto our motto "We serve to Save". Our brave men have engaged themselves in rescuing life and property not only from fire accidents but also from other calamities like floods, earthquakes, rail accidents, stampedes, drownings and so on.

A major disaster is primarily an incident which causes or threatens multiple deaths and injuries or severe disruptions that are all beyond the normal capacities of the Fire, Police and Ambulance services. The type and location of the incident; the number of services likely to be involved and the time to effect rescue, to establish control and to restore normality will determine whether it amounts to a major disaster or not. A structural collapse trapping people, a major explosion, a flood, a landslide and a fire threatening lives and property over a wide area are the likely examples of major disasters.

## **The Disaster Management:—**

The various aspects here can be arranged in the following groups:—

- Preliminary work, Considerations to be borne in mind while doing rescue work.
- Active measures to prevent further loss
- Mitigating the effects

## **Subsequent rehabilitation:—**

- Tasks may arise in varying orders or simultaneously and there is no clear demarcation among different phases of the work.
- Mass disaster management includes all measures taken before, during and after a mass disaster for the purpose of reducing loss.

## **Before Disaster:—**

As with other aspects of the fireman's job, training is very important. In order to cope successfully with major disasters a certain amount of pre-planning is essential. For this purpose each Fire Authority should have its own plan ready for

implementation as the need arises. This will normally form part of an overall major disaster plan drawn in cooperation with the Fire Service, Other emergency services and any other organisations likely to be involved. The main requirement at a major disaster will be to deal with the immediate situation, prevent it from deteriorating further and restoring normal conditions as soon as possible. To help in achieving this end, the plan prepared by the Fire Service should be flexible in operation and capable of adaptations to any circumstance. The most extensive and specialised range of equipment should be maintained. All front line appliances should carry at least some of the basic items.

## **Rescue Tools and Equipment:—**

Some of the most useful devices which have to be kept in preparedness are:—

Lifting devices, levers, jacks, chain hoists, hydraulic rescue equipment, rope and steel wire, fibre ropes, ladders, cutting tools, torch, saws, boat, life jackets, drag hooks, oars, B.A. sets, tarpaulins, first aid box, and a vehicle to transport the squad and the equipment to the scene.

## **During disaster:—**

The primary immediate duties of Firemen will be to effect any necessary rescue to extinguish any fire already in progress and to prevent spread or be ready to deal with any fresh threatened fire. They will also assist other services as far as possible with the first aid to carry out pumping. The officer in-charge of the first appliance to arrive should assess the situation and inform the control about the plan that should be put into effect. This information should include the extent of the hazard and the best means of access. On receipt of a major disaster message, at least 16 pumping appliances and special appliances and the equipment likely to be needed will be mobilized. The plan should also prescribe the number and rank of the officers to attend. There



should be an effective fire control point as soon as possible.

It is necessary to make special arrangements for liaison by a number of portable radios. Where an accident takes place over a wide area subsidiary control points at relevant places should be established from where messages can be relayed back. The officer incharge must also see that there are adequate and effective communication with the main control.

The location of the control point at the scene of the incident should be made known to all involved in the incident by using labeled jackets, flags, notice boards etc.

As a large number of appliances are likely to become committed in the course of a major disaster, it is desirable to establish a holding area where they can be available for rapid deployment. When new appliances and crew arrive at an incident they should at once report into the control point by radio. The officer in charge should also designate individual officers to be responsible for equipment, control unit, safety breathing apparatus, communication, transport, decontamination, press, fire investigation and liaison.

#### **Tackling the incident:—**

Rescue work is usually conducted under difficult and confused conditions. The primary mission of the rescue squad is the removal of the trapped persons and giving first aid. Rescue operations should be carried out systematically in stages. The size up of the calamities forms a basis for all decisions on manpower, equipment required and also the techniques and the methods to be employed.

Locating the trapped persons and rescuing them should be the first function following earthquakes, landslides or collapse of buildings after explosions. Victims with burns in case of fire or explosion should be given first priority. Locating the trapped casualties should be the first function.

#### **Stages of rescue:—**

*Stage-I:* Carrying out immediate rescue after the initial size up.

*Stage-II:* Exploring or searching places where trapped persons are likely to be found.

*Stage-III:* Selective debris removal.

*Stage-IV:* This is the general rubble removal and this is the last stage.

But the immediate rescue work often means a difference between the survival or death of a casualty. So the most effective techniques under the varying conditions of rescue work should be selected. The techniques include debris tunneling, trenching, breaking walls, raising the supporting structural elements, removing walls, and debris handling.

#### **Land slides:—**

Rescuing and removing victims trapped under a landslide present a number of difficult problems. Quick action must be taken here and further land slides should be avoided. As soon as any portion of the body is uncovered, immediate steps should be taken to locate and uncover the victims face and chest and oxygen should be started.

#### **Rescue from flood water/river:—**

The problem in a flowing river is that the body does not remain where it sinks. Methods of body recovery include shore to shore grappling, boat to shore grappling, boat to boat grappling and grappling from a moving boat.

In flooded areas the light boats will have to be used to rescue the survivors in different places in different states. The helicopters can also do great service.

Any major disaster is likely to involve many casualties and the severely injured, the slightly injured and the shocked categories of victims. Hospital services can do much for all of these but efficient and rapid on-site emergency care is vital for their recovery. The handling of casualties will normally be the responsibility of the ambulance staff of fire service, hospital and medical services.

#### **After disaster:—**

The Senior Police Officer will arrange for documentation of casualties and the recording of where they have been taken etc. Any such incident is likely to be protracted. The officer in charge must therefore consider the possible needs for quick reliefs.

#### **Conclusion:—**

It is important that Mass Disaster Plans are always kept up to date and tested periodically.



# DISASTER PREPAREDNESS: TRAINING CURRICULAR DETERMINANTS

*Dr. D.K. Srinivasa*

## **Introduction:—**

Disaster preparedness is defined as a readiness to predict, prevent, respond and cope with the effects of a disaster. Such a preparedness requires an integrated institutional and community effort.

The importance of disaster preparedness and response (DPR) is globally recognised. While relief was the main disaster response activity in the 1970s in many countries including India, gradually the emphasis changed in 1980s to preparedness and response. This focuses on giving structural support to local health services so as to enable them to be ready for future emergencies. This naturally involves training of local personnel, medical and health staff at different levels viz sub-centre, primary health centre, district, state and national level.

The goals of the training would also be different depending on the level and category of the personnel and the tasks expected from them. The training has to focus on the following:

- a) first aid principles,
- b) rescue techniques/evacuation planning,
- c) rapid assessment of health situation and needs,
- d) coordination of large scale disaster operations,
- e) strengthening health information and communication system,
- f) formulation of national policy and preparation of contingency plan.

Depending upon the goals the curricular contents would have to be selected. For instance, how to rescue and evacuate during a flood or cyclone or how to give first aid such as tying bandages, use of splints etc may be the major focus of the curriculum for the local personnel, whereas for the state level officers, planning, coordination, triage, decision making etc. could be the essential requirements.

It would, therefore, be necessary to prepare

courses suited to different needs depending upon the type or category of the personnel and the nature of the disaster i.e. natural or man-made, rapid or slow in onset. A single curriculum will not be able to fulfil all the needs.

In this paper, the general principles of curriculum planning process is described. It is believed that understanding them would help the trainers to plan suitable curriculae depending upon the specific goals of training.

## **Curriculum Planning Process:—**

### **What is a Curriculum?**

Curriculum may be defined as a plan of educational experiences and activities offered to a learner under the guidance of a formal institution. It implies deliberate, systematic and planned attempts to change the behaviour of learners. Here the term behaviour is used to mean an increase or improvement of knowledge development or change in certain habits and attitudes and acquisition of psychomotor and communication skills.

### **What should a curriculum include?**

A written curriculum would help in the organisation of a course better. The components of a curriculum are:—

1. The objectives of the course, i.e. the tasks and the sub-tasks which the participants will have to learn.
2. A statement of teaching learning experiences offered and the training methods which will be used for the different objectives.
3. A time schedule.
4. The methods used to assess the learning outcome of the participants.

## **Steps in curriculum planning:—**

Curriculum planning is a complex process. The following steps help in planning a curriculum.



### *Step 1: Situation analysis:*

This is done to determine the nature and the magnitude of the disasters, the health and the disease problems following the disasters, the health needs and the demands, the existing socio-economic and cultural conditions, the availability of resources, the professional requirements etc. All this information will help in job specification of different personnel and would form the very basis for the curriculum.

### *Step 2: Specification of tasks:—*

Task analysis is a method of looking at some part of a person's job (a task) and writing down what exactly is to be done and under what conditions.

For specification of the condition of work is a very important aspect. Since the conditions of a medical person working in a referral hospital are vastly different from what prevail in the constrained situations of a disaster. In addition, the conditions are very likely to differ much from disaster to disaster e.g. as between a flood situation and an earthquake.

### *Step 3: Formulation of objectives:—*

Task analysis helps in determining what knowledge, skills and attitudes are required for the tasks expected of the trained person.

### *Step 4: Selection of content:—*

Both the analysis of the needs and the statement of objectives provide a preliminary guide for the selection of contents i.e. the subject matter. The content chosen must be relevant to the needs, be feasible and significant to the concept and the

ideas connected to the learning experience, and also create interest.

### *Step 5: Selection and organisation of learning experience:—*

It is important to visualize as to what exactly are the training needs of the health personnel and the expected competencies. The criteria for desirable learning experiences must be applied by asking questions like the following:—

Does it serve the objectives, of the unit? Is it appropriate for the nature of disaster and the level of the health personnel? Can the skills required be learned by it? Care also must be taken to include a variety of ways of learning. For example, these could be group discussions, workshops, case studies, simulated disaster scenario, films or videos etc. Organization includes the scheduling and arranging the time table for various learning activities.

### *Step 6: Evaluation:—*

The curriculum should have a description of nature, frequency and methods, that will be used to evaluate the learning outcomes. Similarly the design should contain a plan for concurrent and terminal evaluation of the curriculum itself.

### *Step 7: Checking for balance and sequence:—*

After the outline of the curriculum is completed in writing, it is necessary to check the overall consistency and balance among the various components. Such an examination of the total plan is required as it will one to see that there are no serious oversights or inconsistencies.

In addition to all this, evaluation of the curriculum itself is essential and would have to be done both during and after implementation.



## GROUP DISCUSSION ON CURRICULAR DETERMINANTS FOR TRAINING AND FUTURE PLANS OF THE JIPMER CENTRE

JIPMER is expected to train key personnel from the States of Andhra Pradesh, Tamil Nadu, Pondicherry, Karnataka and Kerala in Disaster Preparedness and Response. It is necessary as a first step to develop curricula for organising such training programmes and also to prepare a plan regarding the future role of JIPMER Centre. The participants were therefore divided into two groups for holding group discussions and to make recommendations.

### Deliberations and Recommendations of Group-A

The Group-A focussed on curriculum development. Dr. A.J. Veliath was the moderator and Dr. K.R. Sethuraman was the rapporteur. The following points were taken up for discussion:—

- What should be the goals of training programme?
- What levels\* of key personnel are to be trained?
- What types of disasters should JIPMER Centre focus on for training?
- What should be the duration and frequency of training for different levels\* of personnel?
- What type of teaching/learning methods would be effective to achieve the goals?
- What methods of evaluation should be adopted?

(\* Level refers to level in hierarchy and also to the type of trainee, for example: administrator, physician etc.)

### Situation Analysis:—

It was felt that there is at present a lack of awareness of the national policy or guidelines for health professional on disaster management. There is also a lack of effective linkage with various government and non-government organisations and between civil and defence sections—especially during the interdisaster phase. There is a lack of adequate formal training of various personnel, so that the policies by the Centre are not translated

into practical action properly. There is also a lack of adequate communication both intersectorally and vertically down to the community level. The various training programmes in India are only short term adhoc arrangements. Eventhough some data are available, there is a clear lack of hard scientific and epidemiological data on an All India basis to enable a better preparation for the future especially with regard to man-made disasters.

### Recommendations:—

In view of the above, it is necessary to have formal and well stipulated goals of training. These should endeavour:

- i) to train manpower on various aspects of the disaster cycle and the principles of disaster management.
- ii) to develop specific scientific skills on disaster management which should be decided according to the level of the participants and the nature of their work.

The key personnel to be trained are classified as follows:

#### *Level 1: State level personnel:—*

- Relief Commissioner of the respective states,
- Secretaries, Health, Civil Supplies etc.
- Directors of Medical and Health Services.
- other State level officers of different departments.
- State level NGOs.

#### *Level 2: District level functionaries:—*

- District Magistrate,
- District Chief Medical Officer of Health and other district health officials.
- District level NGOs.

#### *Level 3: Block level officials:—*

- Block development officer.
- Medical Officers and other staff members of Primary health centres.



#### *Level 4: Community and village level workers:—*

It was felt that JIPMER should first take up level-1 key personnel for training. Later, if deemed desirable and feasible, Level-2 may be taken for training.

The training programmes should:—

- 1) cover general principles of the disaster cycle and its management;
- 2) focus on disasters common in South India such as floods, cyclone etc.
- 3) focus on man-made disasters as applicable to India. The duration of the training for level-1 should be of 3 days. There can be 2 workshops per year. It was decided that for level-2, the content and duration should be decided in consultation with level-1 functionaries.

The instructional methods to be adopted for training should include:—

- 1) introductory lectures;
- 2) case studies and simulated problems using sand models or computer models;
- 3) group discussions, trigger-films, video clips etc. to motivate the personnel and sensitize them on emotional/religious/social issues involved in disaster.

The core content for level-1 training must consist of:—

- 1) disaster management information systems (DMIS);
- 2) disaster epidemiology;
- 3) rapid assessment and response;
- 4) relief measures;
- 5) intersectoral coordination.

There is a need for continuous evaluation of the training programme. This must include a short-term evaluation based on feedback and performance in simulation exercises and a long-term evaluation based on feedback from the key personnel on how they perform in training other levels of workers, and their own activity during actual disasters.

As a follow-up activity it was suggested by Group-A that observers from JIPMER may visit workshops for level-2 and 3 besides conducting mock-drills (dry-runs) at various levels. Case studies of actual disasters may be conducted and the curriculum revised from these experiences.

#### **Deliberations and Recommendations of Group-B**

Group-B discussed and recommended regarding the future role of JIPMER centre. Dr. Olavi Elo was the moderator and Dr. N. Ananthakrishnan was the rapporteur. The following points were considered for discussion.

- 1) What should be the activities of JIPMER centre?
- 2) What mechanism should JIPMER develop for continuous interaction with other agencies concerned with Disaster Preparedness and Response (DPR)?
- 3) How would JIPMER acquire and disseminate information about DPR?
- 4) In addition to training should/could JIPMER establish a model centre for disaster management.
- 5) How should JIPMER proceed in establishing a resource centre for case studies and research.
- 6) What should be the strategies for carrying the training programme to the district level.

#### **Situation Analysis:—**

As a preliminary to formalising the role of JIPMER in training, the group first focussed its attention on the strength and constraints, weakness of JIPMER in this respect.

JIPMER's strength lies in the following areas:

- i) Its experience in medical education, training of trainers and curriculum development through the National Teacher Training Centre (NTTC) at JIPMER.
- ii) The existing facilities for adequate teaching, research and a library with an on-line link with Medlar as well.
- iii) Its role as a centre recognised for training by national and international agencies.
- iv) Its regional location in proximity to natural disaster prone areas such as Andhra Pradesh, Tamilnadu (for cyclone) and Karnataka (for drought).

It was felt that JIPMER also had certain constraints; these are:—

- i) Lack of administrative and financial autonomy. As JIPMER is a subordinate office



under administrative control of Directorate General of Health Services, there are administrative delays due to the need for getting prior approval for all activities from the Ministry of Health and Family Welfare.

- ii) Unlike other centres like AIIHPH, NICD etc. the faculty at JIPMER have clinical and patient care responsibility also in the attached hospital;
- iii) As yet, JIPMER, has no first hand experience in mass natural disaster relief. It however has considerable experience in the management of mass casualties due to accidents.

JIPMER has the additional opportunity of its linkage with several medical colleges through the NTTC and with the Consortium of five medical institutions (All India Institute of Medical Sciences, New Delhi, Christian Medical College, Vellore, Institute of Medical Sciences, Varanasi, JIPMER, Pondicherry and Department of Medical Education, University of Illinois, Chicago) in curricular innovations. This linkage can be utilised with advantage in introducing the disaster preparedness concept in the undergraduate and postgraduate medical education programmes. Besides, being a referral centre, it can explore the possibility of coordinating with the Government of Pondicherry for both providing disaster relief and training of their health personnel. The National Academy of Medical Sciences (NAMS), New Delhi has a scheme for Continuing Education for medical and health personnel. It was felt therefore that financial assistance from the NAMS can be obtained for organising continuing education programmes for medical and health personnel in this area of disaster management also.

As a first step it is necessary to have linkages with the following institutions:—

- All India Institute of Hygiene and Public Health, (AIIHPH), Calcutta.
- National Institute of Communicable Diseases (NICD), Delhi.
- Indian Institute of Technology (IIT), New Delhi.
- National Environmental Engineering and Research Institute (NEERI), Nagpur.
- Postgraduate Institute of Medical Education and Research (PGIMER), Chandigarh.

— Administrative Staff College of India, (ASCI), Hyderabad.

There is considerable expertise and experience available with the institutions such as IIT, Delhi and PGIMER, Chandigarh on the epidemiology of accidents and accident prevention and with the ASCI, Hyderabad, in training of the top level managers and planners.

#### **Recommendations:—**

- 1) The Directorate General of Health services (DGHS), should take appropriate administrative action to officially designate JIPMER as one of the Training Centres for Disaster Preparedness.

The Director, Emergency Medical Relief should take the initiative towards expediting these administrative decisions and also assure some funds on a long term basis.

- 2) JIPMER, AIIHPH and NICD are directly under the administrative control of DGHS. It is recommended that in order to develop linkages with the designated Centres/Institutions, the DGHS may call a meeting of the heads of institutions and the project coordinators from the above organisations. The status of these institutions must be ratified as Disaster Prepared and Response centres and they must be assigned responsibilities based on their strength and expertise.
- 3) In view of its National Teacher Training Centre, JIPMER should focus on involving other Medical Colleges and also other Health Personnel Training Institutions in training their faculty and more importantly in introducing Disaster Preparedness and Response in their curriculum at the undergraduate and the postgraduate level.
- 4) It is necessary to make an inventory of the Voluntary Organisations (NGO's) involved in Disaster Relief in the local areas and coopt them in the training programme.
- 5) JIPMER should become a resource centre for developing training materials and software in this area and also for library and documentation facilities. Infact it should function as a clearing house. It may receive data from the different departments of



the Central and State Governments, the NGOs, UN agencies and WHO Collaborating Centres in Emergency Preparedness and Response (EPR) in different regions such as:—

- United Nations Disaster Relief Co-ordinator (UNDRO),
- United Nations High Commissioner for Refugees (UNHCR),
- United Nations Emergency Childrens' Fund (UNICEF),
- International Committee of the Red Cross (ICRC),
- League of Red Cross and Red Crescent Societies (LRCS),
- OXFAM,
- Centre for Research on the Epidemiology of Disasters (CRED), Brussels, Belgium,
- Centre for Disaster Preparedness, Management and Nursing (CDP), Rome, Italy,
- Centre for Emergency Preparedness and Response Centres for Disease Control (CDC), Atlanta, USA,
- Centre for Emergency Preparedness and Response, National Public Health Institute, Kuopio, Finland,
- Centre for Emergency Preparedness and Response, Addis Ababa, Ethiopia,
- Emergency Preparedness and Disaster Relief Coordination (PED), Pan Ameri-

can Sanitary Bureau, Washington, USA.

The EPR cell of WHO, could take the initiative in linking JIPMER with these organisations.

- 6) JIPMER should effectively collaborate with state Government of Pondicherry in their Disaster Response activities.
- 7) JIPMER should also envisage/create model centre in Disaster Management; this centre should take active care of disaster situations and also serve as a model centre for demonstration and training.
- 8) JIPMER should also undertake case studies and research on the short and long term impact of the disasters on human health and development. This can be best realised by developing a network among the sister institutions such as AIIPH, Calcutta, NICD, Delhi, ASCI, Hyderabad, IIT, New Delhi, PGIMER, Chandigarh and WHO collaborating centres for Emergency Preparedness and Response for the purpose of research, training and also for preparing training materials. Such a linking would also facilitate creation of a computerised data base on disasters and access to global data base.
- 9) JIPMER could also prepare a long term plan for the next four years indicating the phases of development of the centre reflecting the financial requirements.



# ANNEXURE-I

## LIST OF PARTICIPANTS

Sl. No.	Name	Designation with address
1.	Dr. Olavi Elo	W.H.O. Representative to India, Nirman Bhavan, New Delhi- 110 011.
2.	Dr. Brij Bhushan	Dy. Additional Director General, Emergency Medical Relief, Directorate General of Health Services, Nirman Bhavan, New Delhi-110 011.
3.	Dr. S.P. Mukhopadhyay	Professor & Head of P&SM and In-charge Disaster Management, All India Institute of Hygiene and Public Health, 110, Chittaranjan Avenue, Calcutta-700 073.
4.	Dr. G.S. Ganesan	Cyclone Warning & Research Centre, Regional Meteorological Centre, 50, College Road, Madras-600 006.
5.	Sri G. George	Jt. Secretary (Revenue) cum Additional District Magistrate, Government of Pondicherry, Pondicherry-605 001.
6.	Lt. Col. S.S. Verma	Commanding Officer, Station Health Organisation, Delhi Cantt, Delhi-110 010.
7.	Sri V. Ananthasekar	Dy. Director, Tamilnadu Fire Service, Trichy Region, Trichy-620 001.
8.	Dr. A.W. Deshpande	Assistant Director, National Environmental Engineering & Research Institute, Nagpur-440 020.
9.	Dr. V.M. Meher-Homji	Ecologist, French Institute, 10, St. Louis Street, P.B. 33, Pondicherry-605 001.
10.	Dr. P.N. Pandit	Hony Consulting Surgeon and Visiting Professor (HAL Hospital), 575, 16th Block Main, III Block, Koramangala, Bangalore-600 006.
11.	Dr. Shirdi Prasad Tekur	Community Health Cell, 326, V. Main, I Block, Koramangala, Bangalore-560 034.
12.	Dr. Jacob D. Raj	Executive Director, PREPARE, 4, Sathalvar Street, Mugappair (West), Padi, Madras-600 050.



**PARTICIPANTS FROM JIPMER, PONDICHERRY:—**

13.	Dr. S. Chandrasekar	Director
14.	Dr. A.J. Veliath	Medical Superintendent
15.	Dr. R. Sambasiva Rao	Professor and Head, Department of Microbiology
16.	Dr. K.M. Rajendran	Professor and Head, Department of Anaesthesiology
17.	Dr. N. Ananthakrishnan	Associate Professor of Surgery
18.	Dr. K.R. Sethuraman	Assoc Professor of Medicine
19.	Dr. D. Patro	Assoc Professor of Orthopaedic Surgery
20.	Dr. S. Jayanthi	Assoc Professor of Pathology
21.	Dr. D.K. Srinivasa	Professor & Head of P&SM and Project Officer, NTTC.



## ANNEXURE-II

### PROGRAMME

#### W.H.O. Sponsored Core Faculty Training Workshop on Disaster preparedness

Date : 29th to 31st August 1991.

Venue : LIBRARY SEMINAR HALL, JIPMER.

Project Director:  
Dr. S. Chandrasekar

Project Officer:  
Dr. D.K. Srinivasa

Genl. Rapporteur:  
Dr. N. Ananthakrishnan

29.08.1991 Thursday

9.00 am	Registration
9.30 am	Inauguration Dr. Har Swarup Singh His Excellency the Lt. Governor of Pondicherry.
10.30 am	Tea

#### SESSION I

11.00 am	Chairperson : Dr. S. Chandrasekar Rapporteur : Dr. A.J. Veliath
	Key note address: 'Present Status of Disaster Preparedness at the Global Level' —By Dr. Olavi Elo
12.00 noon	'Consideration of Environmental Issues: Towards Long-term Disaster Preparedness' —By Dr. Meher-Homji
1.00 pm	Lunch

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#### SESSION II

	Chair Person : Dr. Olavi Elo Rapporteur : Dr. A.J. Veliath
2.00 pm	'Disaster Profile in India' —Dr. Brij Bhushan
2.45 pm	Reaction time and Discussion
3.15 pm	Tea
3.30 pm	'Health Aspects of Disasters and their Management' —Dr. S.P. Mukhopadhyay
4.15 pm	Reaction time and Discussion

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30.08.1991 Friday

### SESSION III

Chairperson : Dr. Brij Bhushan  
Rapporteur : Dr. Rajendran

9.00 am	'Relief and Management of Mass Casualties' — <i>Lt. Col. S.S Verma, AMC</i>
9.45 am	Reaction time and Discussion
10.00 am	'Role of Statistical Techniques in Quantitative Risk Assessment' — <i>Dr. A.W. Deshpande</i>
10.45 am	Reaction time and Discussion
11.00 am	Tea
11.15 am	'Role of Voluntary Agencies in Disaster Relief' — <i>Dr. Shirdi Prasad Tekur</i>
12.15 pm	Reaction time and Discussion
12.30 pm	Visit to JIPMER Hospital
1.00 pm	Lunch

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### SESSION IV

Chairperson : Dr. S.P. Mukhopadhyay  
Rapporteur : Dr. Rajenderan

2.00 pm	Experiences from cyclone relief work in Andhra Pradesh-1977 — <i>Dr. P.N. Pandit</i>
2.45 pm	Reaction time and Discussion
3.00 pm	Community Disaster preparedness — <i>The PREPARE way</i> — <i>Dr. Jacob D. Raj</i>
4.00 pm	Visit to Auroville

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31.08.1991 Saturday

### SESSION V

Chairperson : Dr. Olavi Elo  
Rapporteur : Dr. K.R. Sethuraman

9.00 am	'Curriculum Determinants in Relation to Disaster Preparedness' — <i>Dr. D.K. Srinivasa</i>
9.30 am	Group Work on 'Curriculum Development for Training and Future Plans for the Centre'
11.30am	Plenary Session
1.00 pm	Lunch

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## SESSION VI

Chairperson : Dr. A.J. Veliath  
Rapporteur : Dr. K.R. Sethurman

- 2.00 pm Tropical Cyclone—detection and warning system  
—*Sri G.S. Ganesan*
- 2.45 pm Status Paper on 'Disaster Preparedness and Relief—Pondicherry'  
—*Sri G. George*
- 3.30 pm Tea
- 3.45 pm Role of Fire Service in Disaster Relief  
—*Sri V. Ananathasekar*
- 4.30 pm Valedictory Session
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## ANNEXURE-III

### PROGRAMME EVALUATION

A programme evaluation questionnaire was administered at the end of the workshop to obtain views of the participant about the organisation and the arrangements made. Eleven responses were received. All the respondents felt that the objectives of the workshop were relevant, clear and feasible. The topics included in the scientific sessions were 'very educative' and 'helpful in subsequent training'. It was also felt that 'a good mix of government officials, academicians and NGOs gave an overview of the different facets of disaster management'. The methods employed in the various sessions were 'very effective' according to two participants, and 'good' according to the other eight participants. All the respondents observed that the duration of 3 days was 'optimum'. Among the comments or the suggestion made, five wanted more workshops of similar nature while, one participant suggested that ASCI, Hyderabad should be the nodal agency for training the level I personnel i.e. state level administrators and service chiefs. Others gave no suggestions.

The response tabulation is as follows:—

N = 11

	Questions asked	Response	Number
1.	Objectives of the workshop	Relevant & practical	11
2.	Opinion about the relevance of topics in different sessions	Very educative	3
		Good	8
3.	Training methods employed in various sessions	Effective	2
		Good	8
		No comments	1
4.	Duration	3 days Adequate	11
5.	Suggestions:		
	a) More handouts		1
	b) Many more interactions and workshops		3
	c) Level-1 training may be done by ASCI		1
	d) No suggestions		6















